23 ONSHORE NOISE AND DUST IMPACTS

23.1 The table below provides a list of all supporting studies which relate to noise and dust. All supporting studies are provided on the accompanying CD.

Details of study	Location on supporting studies CD
Results of onshore noise surveys and accompanying figures (Xodus, 2011)	ONSHORE\Noise survey

23.1 Introduction

23.1.1 Overview

23.2 This section addresses the impacts due to noise and dust from onshore elements of the Project. The assessment was undertaken by Xodus including their in house acoustics team.

23.3 The assessment includes the effects of noise and dust due to:

- Construction of the Power Conversion Centre (PCC) and Horizontally Directionally Drilled (HDD) sites;
- HDD operation;
- Cable installation works;
- Construction and HDD traffic; and
- Operation of the PCC.

23.4 The Project will be located in a relatively quiet and rural location due to the location of the tidal resource. It is acknowledged that this constraint on the Project means that it will inevitably lead to some increase in noise as a result of construction and operation. The approach adopted for noise has therefore been to minimise any impacts by adopting best available techniques for noise and dust reduction and management.

23.2 Assessment Parameters

23.2.1 Rochdale Envelope

23.5 In line with the Rochdale Envelope approach, this assessment considers the maximum ('worst case') Project parameters. Identification of the worst case scenario for each receptor (i.e. Environmental Impact Assessment (EIA) topic) ensures that impacts of greater adverse significance would not arise should any other development scenario be taken forward in the final scheme design. Table 23.1 describes the detail of the Project parameters that have been used in this assessment and explains why these are considered to be worst case. The potential impacts from alternative Project parameters have been considered in Section 23.9.

Project parameter relevant to the assessment		'Maximum' Project parameter for impact assessment	Explanation of maximum Project parameter
Onshore Power Conversion Centre (PCC)	Construction and decommissioning	Ness of Quoys and Ness of Huna; daytime working for PCC construction.	Assessment of potential impacts associated with the construction of the PCC at both the Ness of Huna and Ness of Quoys. Construction of permanent access road, temporary hard standing using a light excavator, dumper truck and roller. The topsoil will be removed and scrapped down to the bedrock; some bedrock breaking (by excavator breaker) may be required to level the site for PCC foundations. PCC construction will include foundation and floor preparation, using light excavator, dumper truck and roller. Steel structure erected and external cladding fitted using a single small crane and cherry picker. Daytime working only assumed for PCC construction and decommissioning activities.
	Operation	Operating noise from the PCC at either Ness of Quoys or Ness of Huna; 24 operation of the PCC.	Assessment of potential impacts associated with the operation of the PCC at both the Ness of Huna and Ness of Quoys. PCC will be operational 24 hours a day and PCC equipment noisiest when the tide running fastest.
Onshore cable routes between PCC and SHETL substation	Construction and decommissioning	All potential cable corridors between PCC locations and SHETL substation proposed at Phillips Mains (see Figure 2.1) (at EIA commencement); daytime working for cable installation and decommissioning.	Use of a single tractor and cable plough (ploughing method) or single light excavator (cut and backfill method) to bury the cables. Daytime working only assumed for cable installation and decommissioning activities.
Cable landfall	Horizontal Directional Drill (HDD) site construction and reinstatement	Construction of temporary access road and hard standing for HDD compound at either Ness of Quoys or Ness of Huna.	Construction of temporary access off the permanent access road, temporary hard standing for the HDD compound using a light excavator and dumper truck. The topsoil will be removed and scrapped down to the bedrock; some rock breaking (by excavator breaker) may be required to level the site. The HDD compound will move to new positions to complete each different phase of drilling. A new compound area will be prepared for each phase and the previous area reinstated. Daytime working only assumed for HDD site construction and reinstatement activities.
	HDD operation	86 HDD bores drilled from either Ness of Quoys or Ness of Huna; 24 hour operation during HDD.	Assessment of potential impacts associated with the HDD of the cable bores, during the Project construction phase. ▪ 24 hour working assumed for HDD activities.
Offshore Project components		N/A	The offshore Project parameters do not influence the onshore noise and dust impact assessment.

Table 23.1: Rochdale Envelope parameters for the onshore noise and dust assessment

23.2.2 Area of assessment

23.6 It is also important to define the geographical extent of the assessment area. The focus of the onshore noise and dust assessment is concerned with potential impacts on receptors in the area of the onshore PCC installation and operation works, HDD drilling activities and onshore cable installation.

23.7 It should be noted that this assessment was completed on a larger Project area; this has since been refined to a smaller footprint at both the Ness of Quoys and Ness of Huna PCC sites and a single cable corridor to the SHETL substation option areas. The final Project is described in Section 5 and shown in Figure 5.2; the selection process for these is discussed in Section 4.

23.2.3 Acoustic terminology and concepts

23.8 This section provides an overview of the fundamentals of how sound propagates away from an industrial site.

23.9 Increasing the distance from the noise source normally results in the level of noise getting quieter, due primarily to the spreading of the sound with distance, analogous to the way in which the ripples in a pond spread after a stone has been thrown in. Another important factor relates to the type of ground over which the sound is travelling. Acoustically “soft” ground, (such as grassland, ploughed fields etc) will result in lower levels of noise with increasing distance from the industrial site as compared to acoustically “hard” surfaces (e.g. concrete, water, paved areas). The reduction in noise level depends, however, on the frequency of the sound.

23.10 It is common experience that wind affects the way in which sound propagates, with noise levels downwind of a source being louder than upwind. This is partly due to the sound “rays” being bent either upwards or downwards by the wind in a similar way that light is bent by a lens, as shown in Figure 23.1. It is less well known that varying temperatures in the atmosphere can also cause sound rays to be bent, adding to the complexity of sound propagation.

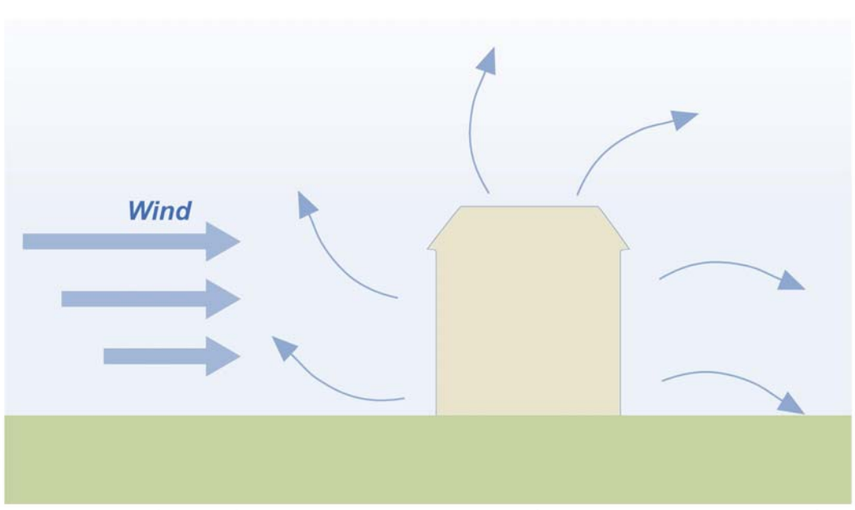

Figure 23.1: Refraction of sound waves due to wind gradients (increasing wind speed with height)

23.11 Another attenuation mechanism is due to absorption of sound by the molecules of the atmosphere. Higher pitched sounds are more readily absorbed than lower pitched sounds. The factors affecting the extent to which the sound is absorbed are the temperature and the water content of the atmosphere (relative humidity).

23.12 Because industrial noise is typically weighted towards the lower frequencies, the effect of varying temperature and humidity is minimal when compared to other factors, such as wind and ground effects. However, where high frequency sounds are encountered, there may well be a significant variation between measured sound levels on different days due to variations in temperature and humidity.

23.13 When listening to noise which occurs out in the open (e.g. from road traffic, aircraft, birds, wind in the trees etc.), it is common experience that the noise level is not constant in loudness, but is changing in amplitude all of the time. Therefore, in order to numerically describe the noise levels, it is beneficial to use statistical parameters. It has become practice to use indices which describe the noise level which has been exceeded for a certain percentage of the measurement period, and also an index which gives a form of average of the sound energy over a particular time interval. The former are termed percentile noise levels and are notated L_{A90}, L_{A50}, L_{A10} etc. and the latter is termed the equivalent continuous noise level and is notated by L_{Aeq}. It is worth noting that if the noise level does not vary with time, then all the parameters, in theory, normalise to a single value.

23.14 With regard to the percentile levels, the L_{A90} is the sound pressure level which is exceeded for 90% of the measurement time. It is generally used as the measure of background noise (i.e. the underlying noise) in environmental noise standards.

23.15 The L_{Aeq} (sometimes denoted $L_{Aeq,T}$) is the equivalent continuous noise level and is an energy averaged value of the actual time varying sound pressure level over the time interval, T. It is used in the UK as a measure of the noise level of a specific industrial noise source when assessing the level of the specific source against the background noise. It is also used as a measure of ambient noise (i.e. the “all-encompassing” sound field).

23.16 The term 'A' weighting implies a measurement made using a filter with a standardised frequency response which approximates the frequency response of the human ear at relatively low levels of noise. The resulting level, expressed in 'A' weighted decibels, or dBA, is widely used in noise standards, regulations and criteria throughout the world.

23.17 For a more detailed analysis of the frequency characteristics of a noise source, then noise measurements can be made in bands of frequencies, usually one octave wide. The resulting levels are termed octave band sound pressure levels. The standard octave band centre frequencies range from 31.5 Hz (about three octaves below middle ‘C’ on the piano) to 8 kHz (about five octaves above middle ‘C’). This covers most of the audible range of frequencies (usually taken to be around 20 Hz to 20 kHz). Octave band noise levels are usually quoted as linear data – i.e. without an ‘A’ weighting filter being applied.

23.18 The term decibel is a relative quantity and should always be referenced to an absolute level. In this section, all sound pressure levels (denoted L_P) are expressed in dB ref 20 µPa. Hence, a sound pressure level of 0 dBA refers to a pressure level of 20 µPa, which is generally taken as the lowest level of sound that the human ear can detect.

23.19 Subjectively, and for steady noise levels, a change in noise level of 2 – 3 dBA is normally just discernible to the human ear. A difference of 10 dBA represents a doubling or halving of subjective loudness.

23.20 Sound power (denoted L_W) is the acoustical power radiated from a sound source. The advantage of using the sound power level, rather than the sound pressure level, in reporting noise from industrial sites is that the sound power is independent of the location of the site, distance from the measurement point and environmental conditions. If the sound power of a source is known, then it is possible to calculate the sound pressure level at a distance away from the source, accounting for the attenuation due to propagation, as discussed above. In this section, all sound power levels are expressed in dB ref 1pW.

23.3 Legislative Framework and Regulatory Context

23.3.1 Noise

Legislation and planning advice

23.21 The EIA Regulations are the only legislation relevant to this assessment.

National Planning Policy

- **Planning Advice Note 1/2011: Planning and Noise**

23.22 Scottish Government guidance is provided primarily through PAN 1/2011. The document gives guidance to local authorities in Scotland on the use of their planning powers to prevent and limit the adverse impact of noise. The PAN is intended to promote the principles of good acoustic design and a sensitive approach to the location of new development. The underlying principle of the PAN is to ensure that the quality of life is not unreasonably affected and that new development continues to support sustainable economic growth.

23.23 The PAN promotes:

- The principles of good acoustic design;
- A sensitive approach to the location of new development;
- The appropriate location of new potentially noisy development;
- A pragmatic approach to the location of new development within the vicinity of existing noise generating uses, to ensure that quality of life is not unreasonably affected and that new development continues to support sustainable economic growth; and
- Early involvement of Environmental Health Officers (EHOs) and/or professional acousticians in proposals which are likely to have significant adverse noise impacts or be affected by existing noisy developments.

23.24 More technically detailed advice for potential noise generating developments in Scotland is provided in Technical Advice Note (TAN): Assessment of Noise. The separation of the TAN allows guidance to be updated without having to review the overarching planning guidance. The TAN recommends several stages as part of a noise impact assessment, summarised as follows:

23.25 Stage 1: Initial Process

- Identification of all noise sensitive receptors (NSR); and
- Prioritise NSR according to level of sensitivity.

23.26 Stage 2: Quantitative Assessment

- Identify type of development; and
- Determine magnitude of impact.

23.27 Stage 3: Qualitative Assessment

- Consider additional features; and
- Adjust magnitude of impact where appropriate.

23.28 Stage 4: Level of significance

- Develop matrix relating receptors sensitivity to the magnitude of impacts; and
- Output results in summary table of significance of noise impacts.

Regional Planning Policy

- **Development plan policies**

23.29 Policy G2 of The Highland Structure Plan (2001), entitled 'Design for Sustainability', states that "Proposed developments will be assessed on the extent to which they… impact on individual and community residential amenity…".

23.30 There is no specific reference to noise and vibration in the Caithness Local Plan (2002).

23.3.2 Dust

Legislation and planning advice

23.31 The EIA Regulations are the only legislation relevant to this assessment.

National Planning Policy

23.32 European Union (EU) legislation on air quality forms the basis for UK air quality policy. Although this assessment specifically considers the effects of dust, the most appropriate plans and policies are held within policies associated with air quality.

23.33 The 1995 Environment Act (HMSO, 1995) required the preparation of a national Air Quality Strategy (AQS) which set air quality standards and objectives for specified pollutants. The Act also outlined measures to be taken by local planning authorities (LPAs) in relation to meeting these standards and objectives (the Local Air Quality Management (LAQM) system).

23.34 The UK AQS was originally adopted in 1997 (Department of the Environment, 1997). This document is reviewed and updated as necessary in order to take account of the evolving EU legislation, technical and policy developments and the latest information on health effects of air pollution. The strategy was reviewed and reissued in 2000 as the AQS for England, Scotland, Wales and Northern Ireland (DETR, 2000). This was subsequently amended in 2003 (DETR, 2003) and was updated in July 2007 (DEFRA, 2007).

23.35 The EU Limit Values (as set out in the EU Council Directives 96/62/EC 'Air Quality Framework Directive' and its daughter directives), the new 'Air Quality Directive' 2008/50/EC and the Air Quality Standards Regulations 2010 laid down statutory air pollutant concentration limits, and the 2000 Regulations (as amended in 2002) effectively implement the AQS objectives. The limit values in most cases are the same, although the achievement dates differ. These values inform regional planning policy against which the assessment of dust is made.

Regional Planning Policy

23.36 Part IV of the Environment Act 1995 introduced a system of LAQM under which Local Planning Authorities (LPAs) are required to review and assess the future quality of the air in their area by way of a staged process. Should this process indicate that any of the AQS objectives will not be met, the LPA must designate that area as an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) to improve the air quality in that area in order to work towards the objectives. The Highland Council has not declared any AQMAs (The Highland Council, 2010).

23.37 Neither the Caithness Local Plan (2002) nor the Highland Structure Plan (2001) make detailed reference to, or provide guidance on air quality issues in the region[1]. The proposed Highland-wide Local Development Plan (HwLDP)[2] (2011) notes that in certain areas of the Highlands there are some issues with air quality, which will be the subject of ongoing monitoring under the AQS. These areas do not overlap with the Project

23.38 Policy 73 of the proposed HwLDP asks that development proposals which may individually or cumulatively have an adverse affect on local air quality, which could cause harm to human health, be accompanied by appropriate information or assessment and details of how such effects would be mitigated.

23.3.3 Standards and guidance relevant to noise

British Standard 4142

23.39 As recommended in PAN 1/2011, British Standard 4142: 1997, 'Method for rating industrial noise affecting mixed residential and industrial areas' is used, where appropriate, to assess noise from proposed industrial and commercial developments as it affects a dwelling. The prime purpose of this standard is to determine the likelihood of complaints about noise from industrial and commercial installations. The foreword to the standard states that it may also be helpful in certain aspects of environmental planning

[1] Still in force at time of EIA and ES compilation
[2] Not adopted at time of EIA and ES compilation

and may be used in conjunction with recommendations on noise levels and methods of assessment published elsewhere.

23.40 The method is based upon a comparison between the noise from the specific source being considered, measured as a time-average ($L_{Aeq,T}$) noise level, with the background noise level (measured as an L_{A90}) in the absence of the specific source. For rating purposes, the noise level measured with the source operating is increased by 5 dBA if the source has any distinctive characteristics (such as whines, hums or bangs), or if it is irregular enough to attract attention. For daytime operations (defined as between 07:00 and 23:00 hours) BS 4142 states that an assessment period of 1 hour should be used, whereas a period of 5 minutes should be used at night.

23.41 The standard specifies that, if the rating level of the noise exceeds the background noise by around 10 dBA or more, complaints about noise are 'likely'. A difference of +5 dBA is of 'marginal significance' with respect to the likelihood of complaints, whilst a difference of -10 dBA or less indicates that 'complaints are unlikely'.

23.42 The foreword to the standard recognises that it is necessarily general in character and may not cover all situations. The likelihood that an individual will complain depends on individual attitudes and perceptions in addition to the noise levels and acoustic features present. Although in general there will be a relationship between the incidence of complaints and the level of general community annoyance, quantitative assessment of the latter is beyond the scope of the standard, as is the assessment of nuisance.

23.43 The standard is not suitable for use when the background noise level is below about 30 dBA and the rating level is below about 35 dBA.

23.44 BS 4142 does not provide guidance relating to the absolute level of noise and, for this, reference can be made to BS 8233.

British Standard 5228

23.45 British Standard 5228-1:2009 "Code of practice for noise and vibration control on construction and open sites. Noise" is the most relevant standard relating to construction noise. The standard was revised in 2009.

23.46 The standard notes that for some large infrastructure projects that require an EIA, construction noise is sometimes assessed by comparing the predicted construction noise (plus pre-construction ambient noise) with the pre-construction ambient noise. However, it notes that a greater difference might be tolerated than for a permanent industrial source.

23.47 For dwellings, times of site activity outside of normal working hours will need special consideration. It suggests that evening noise limits might have to be as much as 10 dBA below the daytime limit and that very strict noise control targets might need to be applied for night-time working.

23.48 Annex E (informative) of the standard provides examples of criteria that can be used for the assessment of the significance of effects due to construction noise. It notes three main reasons for undertaking such an assessment:

- For Environmental Impact Assessments (EIAs);
- Assessments for developments that do not require EIA; and
- Control of Pollution Act (CoPA) Section 61 applications.

23.49 Annex E describes two main approaches for assessing the significance of effects, as follows:

- Significance based upon fixed (absolute) limits and eligibility for noise insulation and temporary re-housing. This is primarily based on guidance given in Advisory Leaflet 72 and is described below; and
- Significance based upon noise change. The standard notes that this assessment method reflects more conventional EIA methodologies for noise.

23.50 With respect to noise change, the standard gives two examples of assessment techniques; the first being the "ABC" method and the latter being the 5 dB change method.

23.51 The ABC method criteria are based on a comparison of the predicted L_{Aeq} level due to construction works with the pre-existing L_{Aeq} before the construction works, rounded to the nearest 5 dB. If the rounded pre-existing L_{Aeq} level is less than the values listed in Category A, then the noise levels listed in the Category A column should be used as the threshold level for significance of construction noise. If the pre-existing L_{Aeq} level is equal to the values listed in Category A, then the noise levels listed in the Category B column should be used as the threshold level for significance. Finally, if the pre-existing L_{Aeq} level is greater than the values listed in Category A, then the noise levels listed in the Category C column should be used.

23.52 The 5 dB change method is based upon a significant effect being deemed to occur where noise from construction activities exceeds pre-construction ambient levels by 5 dBA or more, subject to lower cut-off values of 65, 55 and 45 dB $L_{Aeq,period}$ for the daytime, evening and night-time periods respectively.

23.53 Annex E also includes guidance on setting noise limits for construction activities which will involve long-term earth moving activities (as is the case for the temporary HDD and onshore construction aspects of the Project). It states that this type of activity is more akin to surface mineral extraction sites and that the guidance contained within Mineral Policy Statement (MPS) 2 needs to be taken into account when setting criteria for acceptability. The standard suggests that a limit of 55 dB $L_{Aeq,1h}$ is adopted for these types of activities but only where the works are likely to occur for a period in excess of six months.

23.54 The standard also includes criteria for assessing the requirement for provision of sound insulation or temporary re-housing where, in spite of the mitigation measures applied and any Section 61 consents under the Control of Pollution Act, noise levels at some properties exceed particular trigger levels.

British Standard 8233

23.55 BS 8233 "Sound Insulation and Noise Reduction for Buildings - Code of Practice" provides general guidance on acceptable noise levels within buildings. In sleeping areas the recommended maximum indoor ambient noise levels range from 30 dB L_{Aeq} (good conditions) to 35 dB L_{Aeq} (reasonable conditions). These internal levels correspond to external façade noise levels of 40 - 50 dB L_{Aeq} with windows partially open to allow for ventilation (assuming a 10 – 15 dBA level difference, as recommended in Table 10 of the standard). If the noise of concern contains distinctive characteristics, then these levels may need to be lower.

23.56 As noted in the Standard, the criteria for good and reasonable resting conditions are for "anonymous" and steady noise, such as that from road traffic or continuously running plant. Consequently, these criteria may not always be directly applicable for unsteady noise or for noise which can be attributed to a particular source, such as an industrial development.

23.57 The standard also notes that, for a reasonable standard in bedrooms at night, individual noise events should not normally exceed 45dB L_{AFmax}. This corresponds to an external façade noise level of 55 – 60 dB L_{AFmax} with windows partially open.

23.58 For the daytime, the standard recommends maximum indoor ambient noise levels in living rooms range from 30 dB L_{Aeq} (good conditions) to 40 dB L_{Aeq} (reasonable conditions). These internal levels correspond to external façade noise levels of 40 - 55 dB L_{Aeq} with windows partially open.

23.59 As well as protection for inside the building, the standard makes recommendations for maximum external noise levels in gardens and balconies etc. The standard states that it is desirable that "the steady noise level does not exceed 50 $L_{Aeq,T}$ dB and 55 $L_{Aeq,T}$ dB should be regarded as the upper limit".

World Health Organisation guidance

23.60 In 2009 a report was published presenting the conclusions of a WHO working group responsible for preparing guidelines for exposure to noise during sleep entitled "Night Noise Guidelines for Europe". The document can be seen as an extension to the original 1999 WHO Guidelines for Community Noise. Various effects are described including biological effects, sleep quality, and well-being. The document gives threshold levels for observed effects expressed as $L_{max, inside}$ and $L_{night, outside}$. The L_{night} is a year long average night-time noise level, not taking into account the façade effect of a building. In an exposed population a noise exposure of 40 dB $L_{night, outside}$ is stated as equivalent to the lowest observed adverse effect level (LOAEL) for night noise. Above this level adverse health effects observed are self-reported sleep disturbance, environmental insomnia and increased use of somnifacient drugs and sedatives. Above 55 dB $L_{night, outside}$ cardiovascular effects become the major public health concern. Threshold levels for waking in the night, and / or too early in the morning are given as 42 dB $L_{Amax, inside}$. Lower thresholds are given that may change sleep structure.

23.61 It is relevant to note that taking into account typical night to night variation in noise levels that will often occur due to meteorological effects and the effects of a façade, the night noise guidelines are similar to those previously given in the 1999 WHO report (an external noise level of 45 dB L_{Aeq}), although defined in a different way.

23.62 The major concern in Europe is with respect to noise from transportation systems, and most of the studies on which these guidelines are based relate to this type of noise source. There can be no certainty that the same effects will be observed from noise of an industrial nature, but in the absence of any more detailed information some weight should be attached to the WHO guidance when assessing industrial noise as well.

IOA / IEMA guidance

23.63 A draft guidance document was published jointly in 2002 by the Institute of Environmental Management and Assessment (IEMA) and the Institute of Acoustics (IOA). The document is intended to provide guidance on all aspects of noise impact assessment and was produced to ensure a consensus of the requirements of good practice across the acoustics, as well as environmental impact assessment professions. Following a period of consultation, some amendments were proposed for the guidance, as detailed in a paper presented to the Institute of Acoustics in 2006 by Mr Turner of Bureau Veritas. Although the final document has not yet been formally issued, it is still relevant to this study.

23.64 The 2002 draft guidance document notes that there is currently no guidance on how to undertake a noise assessment for EIA and, although standards and guidance on noise are available, they have not been specifically developed for use in EIA and, as a result, many are used out of context.

23.65 The draft guidance defines noise change as "the difference in acoustic environment before and after the implementation of proposals" and defines the noise impact as "the consequence of a noise change. This may be in the form of annoyance caused or a change in the degree of intrusion or disturbance."

23.66 The Institute of Acoustics paper in 2006 provided a summary of the proposed changes to the original draft document. The 2006 paper includes guidance on setting noise impact criteria for impacts on people which are reproduced in Table 23.2. This table presents the scale of effects of noise on humans correlated to suggested semantic descriptors and significance criteria.

Perception	Impact	Semantic descriptor	Significance
Not noticeable	None	No impact	Not significant
Noticeable	Non-intrusive Noise can be heard, but does not cause any change in behaviour or attitude, e.g. turning up volume of TV, speaking more loudly, closing windows. Can slightly affect the character of the area but not such that there is a perceived change in the quality of life.	Slight	Not significant
Noticeable	Intrusive Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of TV, speaking more loudly, closing windows. Potential for non-awakening sleep disturbance. Affects the behaviour such that there is a material change in the quality of life.	Moderate	Significant
Noticeable	Disruptive Causes a material change in behaviour or attitude, e.g. avoiding certain activities during periods of intrusion. Potential for sleep disturbance resulting in difficulty getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in character of the area.	Substantial	Significant
Noticeable	Physically Harmful Significant changes in behaviour and/or inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/ awakening, loss of appetite, significant medically definable harm, e.g. noise induced hearing loss.	Severe	Significant

Table 23.2: Generic scale of noise impacts on people

23.67 The 2006 paper notes that "one of the key conclusions reached by the working party following consultation was that the guidelines should more strongly emphasise its recommendation of a shift away from the common practice of relying on simple decibel change semantic scales as the key indicator of impacts and their significance. The guidelines promote a more sophisticated approach of weighing up all the objective and subjective factors (including decibel change where appropriate) to reach a reasoned judgement of the impacts and their significance."

Department of Environment Advisory Leaflet 72

23.68 Guidelines for noise from construction activities were given in the old Department of Environment Advisory Leaflet 72, 'Noise Control on Building Sites' [Ref. 0]. The leaflet states that, for rural, suburban and urban areas away from main road traffic and industrial noise, noise levels between 07.00 and 19.00 measured outside the nearest window of the property should not exceed 70 dBA. The recommended maximum level increases to 75 dBA in urban areas near main roads in heavy industrial areas.

23.69 The leaflet does not specify a measurement parameter but it does state that the limit is as "measured using a simple sound level meter". Given that the leaflet was published before integrating sound level meters were commonplace, this implies that the limit should be based on the instantaneous sound pressure level as opposed to a long term average such as $L_{Aeq,12h}$.

23.70 The leaflet also states that building work should not be allowed to disturb people sleeping nearby, although it does not quantify what levels of noise are likely to disturb sleep.

23.71 This leaflet is now over thirty years old (the last version was 1976), is out of print and has been superseded by guidance provided in other, more recent, guidance and standards, such as BS 5228 and MPS 2. There is some doubt regarding whether that Advisory Leaflet is still current (BS 5228 is silent on the matter), although it is still regularly referred to when assessing the impact due to construction activities.

Design Manual for Roads and Bridges (DMRB)

23.72 The Design Manual for Roads and Bridges (DMRB) Volume 11 (Highways Agency, 2011) sets out the overall assessment process for new or altered highways. DMRB Section 3 Part 7 relates to the assessment of noise and vibration. Whilst it is principally concerned with the assessment of increased noise due to new or altered roads, it is nevertheless considered reasonable to use its methodology as a guide to the significance of increased traffic noise levels from intensification of use of an existing highway.

23.73 In the UK, use is made of the $L_{A10,18h}$ noise index based on the categorised annual average weekday traffic flow, in relation to the determination of eligibility under the Noise Insulation Regulations for new or altered highways. For the assessment of the suitability of a site for residential development adjacent to an existing road use is made of the daytime and night-time L_{Aeq} noise indices.

23.74 It is generally accepted that increased road traffic noise can have both a short and long-term effect, in that a sudden change in noise will create a greater impact in the shorter term than over a longer period time. (The same phenomenon may also apply to other sources of noise, such as continuously operating industrial sites, although this is less well documented). Table 23.3 gives the DMRB classification of noise impacts in the short term and Table 23.4 for the long term impacts. These are based on the $L_{A10,18h}$ noise index but changes to the L_{Aeq16h} index would be expected to give similar results.

Noise change, dB $L_{A10,18\,h}$	Adverse / beneficial	Significance of any effect
0	Adverse	No change
0.1 – 0.9	Adverse	Negligible
1 – 2.9	Adverse	Minor
3 – 4.9	Adverse	Moderate
5+	Adverse	Major

Table 23.3: Significance criteria for road traffic noise changes – short term

Noise change, dB $L_{A10,18\,h}$	Adverse / beneficial	Significance of any effect
0	Adverse	No change
0.1 – 2.9	Adverse	Negligible
3 – 4.9	Adverse	Minor
5 – 9.9	Adverse	Moderate
10+	Adverse	Major

Table 23.4: Significance criteria for road traffic noise changes – long term

Mineral Policy Statement (MPS) 2

23.75 Landmark appeal decisions have utilised the guidance contained within Minerals Policy Statement (MPS) 2 (or its predecessor, MPG 11) where the construction works involve long-term earth-moving activities. This approach is now included in BS 5228.

23.76 It is worth noting that the equivalent to MPS 2 in Scotland is PAN 50 (as referenced in paragraph 35 of PAN 1/2011). Furthermore, MPS 2 has now been revoked in England and replaced by the new National Planning Policy Framework and the accompanying Technical Guidance. However, reference is made in this section to MPS 2 due to its inclusion in BS 5228, in an informative Annex E.

23.77 Guidance given in MPS2 suggests that a noise limit of 70 dB $L_{Aeq,1h}$ for up to 8 weeks per year is appropriate in mineral extraction sites for the essential construction of baffle mounds. For longer term noisier activities, a lower limit should be considered. The guidance suggests that noise should not exceed the background level by more than 10 dBA, subject to a maximum of 55 dB $L_{Aeq,1h}$. Evening limits should not exceed background by more than 10 dBA and night-time limits should not exceed 42 dB $L_{Aeq,1h}$.

23.78 It is unlikely that construction of the PCC or HDD sites would count as long-term earth moving activities. Nevertheless, it is considered relevant to pay heed to the guidance in light of its inclusion in the British Standard and like mineral extraction, the development of tidal stream energy is limited by the resource location. The location of the HDD and PCC is therefore geographically linked to the resource of the Inner Sound.

23.3.4 Summary of guidance for use in assessing noise

23.79 Table 23.5 summarises the relevant criteria adopted to assess the impact of noise from the Project for each type of operation.

Type of receptor	Type of noise	Type of assessment	Relevant guidance / standards	Assessment
Residential (construction phase)	All-encompassing construction noise.	Absolute noise level assessment.	PAN 1/2011, BS 5228 / MPS 2 / AL72.	Comparison to limits in MPS 2 / AL72.
	All-encompassing construction noise.	Noise change.	PAN 1/2011, BS 5228.	Assessment of noise change in terms of ambient noise and any other relevant parameters.
	Construction and drilling traffic noise.	Noise change.	PAN 1/2011, DMRB.	Assessment of noise change.
Residential (operational phase)	All-encompassing ambient noise.	Absolute noise level assessment.	PAN 1/2011, BS 8233 / WHO.	Comparison to guideline limits for annoyance and sleep disturbance.
	All-encompassing noise.	Noise change.	PAN 1/2011, IEMA Guidelines for noise impact assessments.	Assessment of noise change in terms of ambient noise and any other relevant parameters.
	Noise from industrial premises.	Level difference.	PAN 1/2011, BS 4142.	Assessment of specific noise rating level compared to background noise.

Table 23.5: Summary of relevant guidelines for assessing impact of noise

23.3.5 Guidance relevant to dust

23.80 No specific guidance (such as thresholds) exist for the impact assessment of dust, however the following guidance documents assist in managing dust emissions at construction sites and are therefore deemed relevant to this assessment.

Scottish Environment Protection Agency guidance

23.81 The Scottish Environment Protection Agency (SEPA) has been involved in the production of guidelines relevant to dust and air quality issues. This guidance document, Pollution Prevention Guidelines 6 (PPG6) – *Working at construction and demolition sites* – has been prepared in conjunction with the Environment Agency and Northern Ireland Environment Agency (NIEA) (Environment Agency (2010). This guidance recommends and refers to a best practice document by the Greater London Authority and London Councils (2006), discussed below.

Greater London Authority and London Councils best practice guidance

23.82 This document, '*The control of dust and emissions from construction and demolition*', provides best practice guidance for construction and demolition sites. It sets out the potential effects of air quality issues as well as suggesting relevant mitigation and control measures for sites with different risk ratings and specifically relating to dust emissions.

23.4 Assessment Methodology

23.4.1 Scoping and consultation

23.83 Since the commencement of the Project, consultation on onshore noise issues has been ongoing. Table 23.6 summarises all consultation relevant to onshore noise. In addition, relevant comments from the EIA Scoping Opinion are summarised in Table 23.7, together with responses to the comments and reference to the Environmental Statement (ES) sections relevant to the specific comment.

Date	Stakeholder	Consultation	Topic/specific issue
7th April 2011	Marine Scotland and SNH	Pre-Scoping meeting	EIA surveys and studies required and the data needs for each EIA study.
27th May 2011	Marine Scotland, statutory consultees and non statutory consultees	Submission of EIA Scoping Report	Request for EIA Scoping Opinion from Marine Scotland and statutory consultees and request for comment from non statutory consultees.
30th June – 2nd July 2011	Local stakeholders	Public Event - EIA Scoping	Public event to collate information/opinions on proposed EIA scope.
9th August 2011	The Highland Council (THC)	Telephone conversation with EHO	Baseline survey planning and assessment methodology.
14th September 2011	THC	Meeting	Planning pre application meeting. Presentation on overall Project and results of EIA studies to date.
31st September 2011	Marine Scotland, THC, statutory consultees and non statutory consultees	Receipt of EIA Scoping Opinion	Receipt of response to EIA Scoping Report and other comments from non statutory consultees.
10th October 2011	THC	Receipt of pre application advice	Receipt of pre application advice from THC
18th November 2011	THC	Telephone conversation with EHO	Discussion of criteria for noise impact assessment.
5th December 2011	THC	Telephone conversation with EHO	Discussion of criteria for noise impact assessment.
6th – 7th December 2011	Local stakeholders	Public Event – pre application consultation	Public event to communicate the findings of the EIA to local stakeholders.

Table 23.6: Consultation undertaken in relation to onshore noise and dust

Organisation	Key concerns	Response	ES section within which the specific issue is addressed
SEPA	The local authority is the responsible authority for local air quality management under the Environment Act 1995, however we recommend that this development proposal is assessed alongside other developments that are also likely to contribute to an increase in road traffic. This increase will exacerbate local air pollution and noise issues, particularly at busy junctions and controlled crossing points. Consideration should therefore be given to the cumulative impact of all development in the local area in the ES or supporting information. Further guidance regarding these issues is provided in NSCA guidance (2006) entitled Development Control: Planning for Air Quality.	The Highland Council's environmental health department was consulted prior to undertaking the noise assessment to seek their views. It was the view of the council that the main concern was likely to be the 24/7 drilling operations, particularly at night. The Council requested that noise surveys should be undertaken under light wind conditions to reflect the "worst case" scenario for assessing the impact from the	Sections 23.6.5 Baseline Description and 23.6 Construction Impact Assessment
	Excavation works, particularly through drilling and blasting, may cause nuisance to adjacent land users due to the generation of dust and noise. Comments from the local authority environmental health officers should be sought on the potential nuisance to adjacent land users during the construction and decommissioning phases of the Project.	Project. The generation of dust is also considered in this section.	
	Where borrow pits are proposed, information should be provided regarding their location, size and nature including the depth of the borrow pit floor and the final reinstated profile. The impact of such facilities (including dust, blasting and impact on water) should be appraised as part of the overall impact of the scheme. Information should cover, in relation to water, at least the information set out in PAN 50 Controlling the environmental effects of surface mineral workings (Paragraph 53) and, where relevant, in relation to groundwater (Paragraph 52).	No borrow pits will be required for the Project and therefore have not been considered in the impact assessment.	N/A
JMP	Impacts to sensitive receptors associated with noise and vibration arising from the proposed development during the construction and operational phases should be considered. Operational traffic noise and construction traffic noise should be assessed by considering the increase in traffic flows and following the principles of CRTN. Design Manual for Roads and Bridges (DMRB) Vol 11 states: "in the period following a change in traffic flow, people may find benefits or disbenefits when the noise changes are as small as 1dB(A) - equivalent to an increase in traffic flow of 25% or a decrease in traffic flow of 20%. These effects last for a number of years".	DMRB is geared towards motorways and trunk roads. Although the document suggests that the nuisance criteria can be used even in cases where the traffic is not free flowing, it is questionable whether the criteria should be used for assessing traffic noise due to an industrial development where there will be no changes to the road network itself. Nevertheless, there is a need to assess the impact due to construction traffic noise.	Section 23.6 Construction Impact Assessment
	PAN 56 advises that a change of 3 dBA is the minimum perceptible under normal conditions, and a change of 10 dBA corresponds roughly to halving or doubling the loudness of a sound.	PAN 56 has now been replaced by PAN 1/2011, which is referenced in the assessment.	Section 23.3 Standards and Guidance
	Therefore, the ES should consider potential impacts to identified trunk road receptors, in terms of: 1) Predicted noise levels from construction traffic; and 2) Any increases to road traffic attributed to the Proposed Development.	Operational traffic is not likely to have a significant impact on noise levels and has been scoped out of this assessment. Construction traffic noise has been assessed.	Section 23.6 Construction Impact Assessment
The Highland Council	The Highland Council's EHO was consulted by phone on 9th August 2011. The EHO highlighted HDD noise as a potential concern and stated, if possible, that any particularly noisy activities should be undertaken during the daytime. He requested that noise monitoring should be undertaken during light wind conditions due to variability in the weather for the location.	Baseline noise measurements were subsequently undertaken during unusually calm conditions for the region.	Sections 23.5 Baseline Description

Table 23.7: Scoping comments relevant to onshore noise

23.4.2 Desk based assessment

Noise

23.84 In order to assess the noise impact associated with HDD activities and the construction and operation of the PCC, it is necessary to predict the likely noise levels which will be generated by the Project. A computer based noise model (using CadnaA software) has been developed to predict the noise levels. The detailed terrain model for the development area was based on digital mapping data from Ordnance Survey.

23.85 The source term levels (i.e. the calculated sound power levels of equipment) were entered into CadnaA to calculate the expected sound pressure levels in and around the site and in particular at the community receptors. CadnaA uses the propagation method described in ISO 9613-2:1996, "Acoustics -- Attenuation of sound during propagation outdoors -- Part 2: General method of calculation".

23.86 The ISO 9613 methodology uses correction terms, applied to the source term level, for various factors affecting the propagation of noise from the source, to calculate a sound pressure level under meteorological conditions favourable to propagation (i.e. light downwind or under a moderate temperature inversion). The standard includes terms for geometrical divergence, atmospheric absorption, ground effects, reflections and screening due to obstacles.

23.87 Noise modelling scenarios have been developed for the potential construction and HDD operations at Ness of Huna and Ness of Quoys and for operational PCC noise at both potential sites.

23.88 Expected sound pressure levels due to construction have been predicted using the methodology defined in BS 5228 and utilising information on the construction method, size, vehicle access route and the type and quantity of plant required to construct the new PCC site, access track and cable routes. This information was used to calculate the range of noise levels likely to be encountered at each of the noise sensitive receptors as well as typical noise levels for each phase of construction. Increases in traffic noise have been calculated, where appropriate, using the methodology defined in the Calculation of Road Traffic Noise (CRTN).

23.89 The HDD noise models are based on noise data provided to Xodus by potential drilling contractors for the drilling rigs and on noise data from previous measurements undertaken on ancillary equipment. It should be noted that the HDD contractor has not yet been chosen so further modelling and specification of noise control measures may be required later in the development. The principal noise sources will be the HDD drilling rig, generators, mud pumps and shale shakers. It should be noted that the equipment noise data provided by the potential drilling contractors was very basic and it is not known, for example, whether the noise measurements near the rig were affected by extraneous noise from other sources. It is considered that this represents a "worst case" scenario because any extraneous noise affecting the measurements would result in a higher estimation of the sound power level of the rig than used in this assessment.

23.90 The operational noise levels for the PCC are based on noise data supplied by manufacturers for typical equipment that might be installed. The equipment, including transformers and air blast coolers, will be housed in three Power Conversion Unit Buildings (PCUBs) which are currently proposed to be clad using an acoustic cladding system. The system is likely to comprise an external cladding layer (e.g. trapezoid steel or polycarbonate), a 150mm layer of mineral wool (of nominal density 90kgm^{-3}) and an inner perforated liner. The primary noise source will be the Thermal Exchange AF500 air blast coolers which produce a sound pressure level of 56 dBA at 10m for free-standing, unenclosed units.

23.91 Ventilation louvers will be provided along the top of the long side walls on opposing walls. This will provide a through draft for normal use. In addition, a back up ventilation system will be provided using a duct within the apex of the roof, with an outlet on the north façade (facing out away from residential properties), with a louver inlet at low level on the opposing south facing walls. All louvers will be of the acoustic type and it has been assumed that they will be approximately 300mm in depth.

Dust

23.92 A desk study has been undertaken in order to evaluate the Project activities which have the potential to generate airborne dust, including PM_{10}[3] which could affect human health, vegetation and local air quality.

23.4.3 Field survey

Baseline noise survey locations

23.93 For the purpose of determining the baseline noise level, seven locations were chosen to represent the most likely affected areas in terms of the potential noise impact from construction and operation of the Project. The monitoring locations are described in Table 23.8 and are shown in Figure 23.2.

Location No.	Description	Comments
1	Norwin	Representative of baseline noise levels for locations bordering the HDD and PCC site at Ness of Huna and near the potential cable route between the Ness of Huna and Ness of Quoys.
2	Quoys	Representative of baseline noise levels for locations bordering the HDD and PCC site at Ness of Quoys and near potential cable route options from the Ness of Quoys.
3	The Cottage	Representative of baseline noise levels for properties in and around Gills Bay, close to the A836 road and potential cable routes east along the coast from Ness of Quoys and through the Gills area.
4	East Mey	Representative of baseline noise levels for properties in East Mey close to the A836 road and potential cable routes.
5	Hill of Rigifa	Representative of baseline noise levels for properties around Hill of Rigifa and near to potential cable routes and potential SHEPD substations sites in this area.
6	Roadside	Representative of baseline noise levels for properties near to potential cable routes south of Gills.
7	Highfield, Warse	Representative of baseline noise levels for properties in Warse and near potential cable routes in this area.

Table 23.8: Baseline noise measurement locations

Baseline survey equipment and methodology

23.94 Unattended continuous long-term noise monitoring equipment was installed at two locations – location 1 (Norwin, near Ness of Huna) and location 2 (Quoys). They represent the nearest and most sensitive receptors in order to determine the background and the ambient noise levels within the vicinity of the two proposed HDD and PCC sites. Attended noise monitoring was also carried out at these two locations and five other locations.

23.95 Type 1 Larson Davies 820 sound level meters (SLM) fitted with weatherproof windshields were used for the unattended continuous measurements taken at locations 1 and 2. The meters were powered by dry cell batteries and stored inside weatherproof security cases. The meters were left on site to log noise levels over the period of 23rd – 26th August 2011. The instrumentation was calibrated before and after the measurement period using a calibrator. No significant drift in calibration occurred. Overall $L_{Amax,F}$, $L_{Aeq,T}$, $L_{A10,T}$, $L_{A50,T}$, $L_{A90,T}$ percentile levels were measured over consecutive 5 minutes periods.

23.96 A Type 1 Larson Davis 824 sound level analyser, fitted with a windshield, was used for the short-term attended measurements. The SLM was calibrated before and after each measurement by using a hand held calibrator. Overall L_{Amax}, $L_{Aeq,T}$, $L_{A10,T}$, $L_{A50,T}$ and $L_{A90,T}$ percentile levels were measured over pre set intervals of 5 minutes. The microphone was mounted on a tripod at a height of 1.5m above ground level. In order to minimise the influence of reflections, the measurement points were chosen to be at least 3.5m from any reflecting surface other than the ground.

[3] Particle matter of size less than or equal to 10 micrometers.

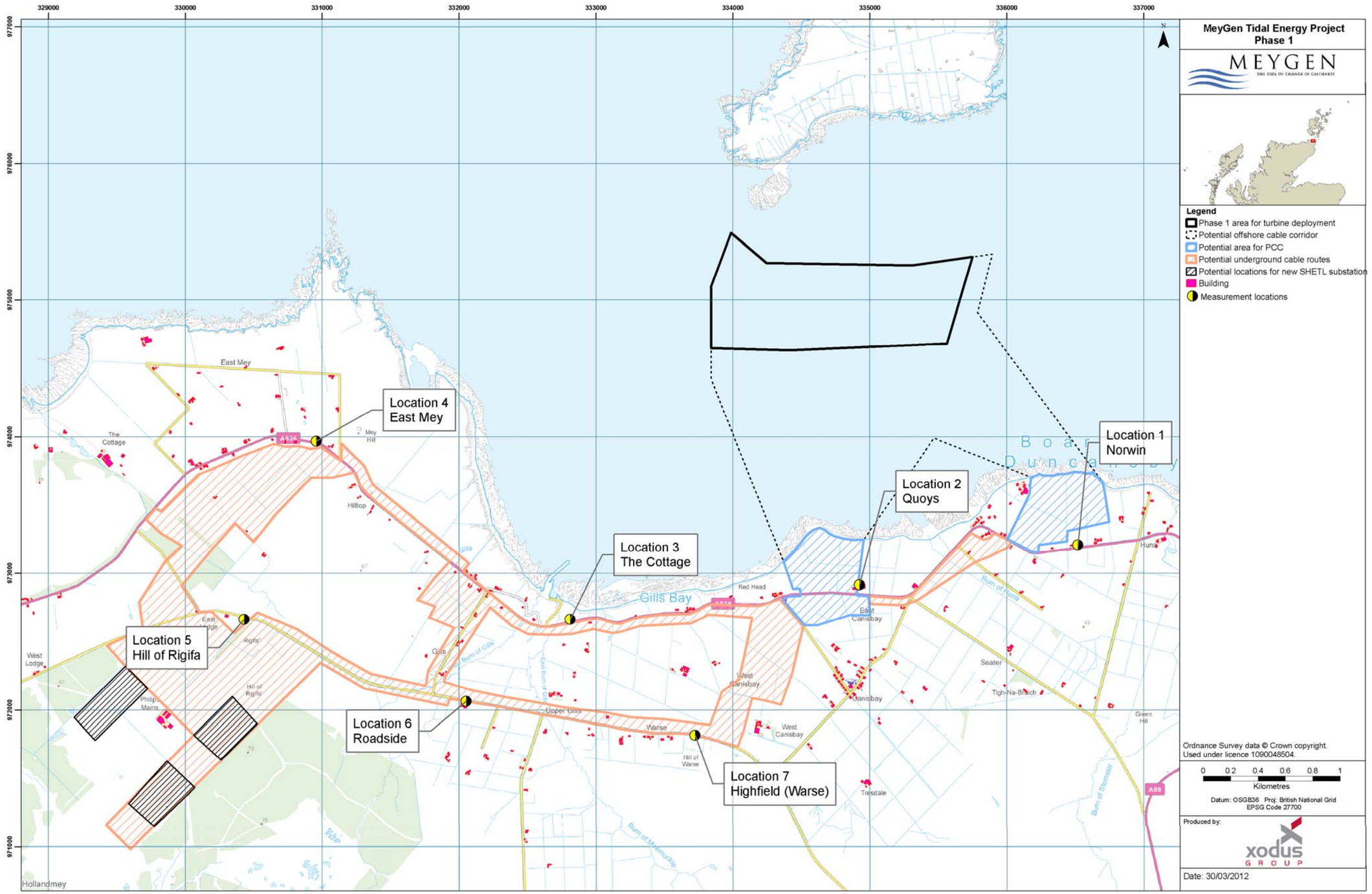

Figure 23.2: Noise monitoring locations

23.97 These attended measurements were taken at locations 1 - 7. The measurements at locations 3 – 7 were undertaken during the daytime period only (because these locations are representative of those which will be primarily affected by cable route construction, which will take place in the daytime). An additional attended survey was undertaken at Locations 1 and 2 during the night-time to obtain observations about meteorological conditions and sources of noise contributing to the overall noise level. For this survey, the data from the unattended noise monitor was used.

23.98 Observations of local meteorological conditions were made during the attended noise monitoring. These observations included wind speed, relative humidity and temperature. The survey was undertaken under light wind conditions, this therefore represents a "worst case" scenario in terms of assessing the impact of the Project.

Baseline survey results analysis

23.99 Noise levels will vary over the course of the day and night and on different days, primarily due to differences in meteorological conditions and varying levels of anthropogenic activity. However, it is useful to determine single numbers for use in assessing the effects of a development. BS 4142 does not define a robust measurement method for determining the background noise level based on long-term monitoring results. For the purposes of this Project, the arithmetic average of the ambient and background noise levels has been taken, minus one standard deviation, to provide an indication of the baseline noise. Work on previous projects has shown this method to give a reasonable measure of background noise levels in rural environments. It is recognised that the derived baseline noise levels will be, by necessity, a simplification of the real noise environment. However, it is considered that by subtracting one standard deviation from the data this will result in an assessment which is robust for the majority of situations encountered. It is considered that this assessment represents a 'worst case' scenario as the noise monitoring was undertaken during unusually calm meteorological conditions for the region. Detailed results of the noise monitoring are provided on the supporting studies CD (Xodus, 2011).

23.100 Average wind speeds for Kirkwall between 1971–2000 are presented in Table 23.9, based on information from the Met Office website. It is worth noting that average wind speeds are very high in comparison to the range of wind speeds encountered during the survey. This reinforces the view that the baseline noise levels presented in this report are unusual and that noise levels under even average conditions will be significantly higher.

Month	Average wind speed at 10 m height, ms^{-1}
January	8.6
February	8.1
March	8.0
April	6.8
May	6.2
June	5.8
July	5.6
August	5.5
September	6.6
October	7.5
November	7.8
December	8.0
Year	7.0

Table 23.9: Average wind speed per month 1971 – 2000

23.4.4 Significance criteria

23.101 Where appropriate the methodology used follows that outlined in Section 8. Variations from this are explained below.

Noise

23.102 The impact and significance criteria used to assess operational and construction and installation noise have been developed taking into account the sensitivity of the receiver and the potential magnitude of the impact (in terms of noise change, absolute levels and the likelihood of occurrence (i.e. whether continuous or temporary)). The magnitude and sensitivity are combined to evaluate the consequence and significance of the impact, as detailed in Table 8.2 (significance rankings) in Section 8. Those impacts rated as moderate, major or severe are considered potentially significant under the EIA Regulations.

23.103 Table 23.10 summarises the definitions of the sensitivity of receiver sensitivities used for this Project, adopted from PAN 1/2011 and the accompanying TAN. It should be noted that the noise sensitive receiver locations in the vicinity of the Project are primarily residential in nature, although there is a church near the proposed PCC/HDD site at Quoys. Other types of receptor do exist in the area, but they are much further away from the development area, so will be much less affected by noise. As a consequence, the impact criteria for onshore noise impacts have been developed assuming high sensitivity of the receptors.

Sensitivity of receptor	Definition	Examples of receiver
High	Receptors where people or operations are particularly sensitive to noise	▪ Residential properties, including gardens. ▪ Quiet outdoor areas used for recreation. ▪ Schools. ▪ Hospitals. ▪ Residential care homes. ▪ Places of worship.
Medium	Receptors moderately sensitive to noise, where it may cause some distraction or disturbance	▪ Offices. ▪ Bars, cafes, restaurants where external noise may be intrusive. ▪ Sports grounds where spectator noise is not a normal part of the event and where external noise may be intrusive.
Low	Receptors where distraction or disturbance from noise is minimal	▪ Buildings not occupied during working hours. ▪ Factories and working environments with existing high noise levels. ▪ Sports grounds where spectator noise is a normal part of the event. ▪ Night clubs.

Table 23.10: Definitions for sensitivity of receptor

23.104 The significance of impacts on the receptors has been defined in Table 23.11, taking into account both the absolute ambient noise level and the change in ambient noise. The rationale for this is based on the assumption that a given change in noise level would have a greater impact if the end absolute noise level exceeds the criteria in WHO Guidance and BS 8233 for annoyance or sleep disturbance. Thus, if the end noise level is less than the absolute noise level criteria for onset of sleep disturbance and the change in noise will not be noticeable (i.e. less than 3 dBA change) then it seems logical that the impact of the development would be negligible. Likewise, it is unlikely that even a large change in ambient noise would result in a severe impact unless the criteria for sleep disturbance or annoyance were also exceeded. These assumptions are based on the philosophy described in the generic scale for assessing impacts on people, as summarised previously in Table 23.2. It should be noted that, for operational noise, the impact will be continuous once the PCC is operational. As a consequence, the impact criteria for operational noise have been assigned using lower values than would be used to assess the impact due to temporary noise, such as due to construction and installation.

Ambient noise level with PCC operation	Noise change, dBA	Consequence
Any	0	Negligible
≤ 55 dB $L_{Aeq,1h}$ (day) ≤ 45 dB $L_{Aeq,1h}$ (night)	< 3	Negligible
	3 - 4.9	Minor
	5 - 9.9	Moderate
	≥ 10	Major
> 55 dB $L_{Aeq,1h}$ (day) > 45 dB $L_{Aeq,1h}$ (night)	< 3	Minor
	3 - 4.9	Moderate
	5 - 9.9	Major
	≥ 10	Severe

Table 23.11: Definitions of consequence for operational noise (high sensitivity receptors)

23.105 In addition to the above impact criteria, a BS 4142 assessment has also be undertaken, where appropriate, to determine the likelihood of complaints due to the PCC in the short term (i.e. within the first year or so following the commencement of operation of the Project).

23.106 For drilling and construction noise, which will be temporary in nature, it is considered (based on the guidance in BS 5228) that residents will be willing to tolerate both higher absolute noise levels and higher changes in noise if they know that the impact will not be permanent. The proposed impact criteria take into account the guidance provided in BS 5228, Advisory Leaflet 72 and MPS 2. The premise on which the criteria are based is that a temporary impact would not be significant if the relevant absolute noise criterion for that period is not exceeded. Thus, impacts become more substantial for a given change in noise level once 45 dBA is exceeded at night (i.e. the onset of sleep disturbance effects) and 55 dBA for the daytime (based on the lower range of proposed limits in BS 5228 / MPS2 and to avoid the onset of annoyance). The night-time level of 55 dBA used in the table is based on the WHO interim target. These criteria relate to activities lasting for more than 8 weeks and it would be reasonable to relax them for shorter-term activities, if they occur, subject to the use of best practicable means to reduce noise.

Ambient noise level with HDD / construction	Noise change, dBA	Consequence
Any	0	Negligible
≤ 55 dB $L_{Aeq,1h}$ (day / weekend) ≤ 50 dB $L_{Aeq,1h}$ (evening) ≤ 45 dB $L_{Aeq,1h}$ (night)	0.1 – 4.9	Negligible
	≥ 5	Minor
> 55 dB $L_{Aeq,1h}$ (day) > 50 dB $L_{Aeq,1h}$ (evening / weekend) > 45 dB $L_{Aeq,1h}$ (night)	0.1 – 4.9	Minor
	≥ 5	Moderate
> 75 dB $L_{Aeq,1h}$ (day) > 65 dB $L_{Aeq,1h}$ (evening / weekend) > 55 dB $L_{Aeq,1h}$ (night)	0.1 – 4.9	Moderate
	5 – 9.9	Major
	≥ 10	Severe

Table 23.12: Definitions of consequence for construction and drilling noise (high sensitivity receptors)

Dust

23.107 The significance criteria relating to any changes in air quality due to dust have been established through consideration of the following factors:

- Duration of activity;
- Exceedence of standards (such as the AQS objectives which differ for each type of pollutant);
- Geographical extent;
- Magnitude of change; and
- Permanence.

23.108 The significance of potential impacts is assessed with reference to Section 8 of this ES and considers the magnitude of impact against the sensitivity of receptors. The sensitivity of receptor is defined in terms of the quality of the local air resource and its susceptibility to change in conditions (Table 23.13) and the magnitude is considered in terms of deviation from the baseline and the sensitivity of receptors (Table 23.14)

Sensitivity of receptor	Definition
Very High	Environment is easily subject to major changes due to dust. Sites contain features of international or national conservation or cultural designation, or permanent reduction of anthropogenic activity.
High	Environment is subject to large changes due to dust. Sites contain features of international or national conservation or cultural designation, or long-term or permanent reduction of anthropogenic activity.
Medium	Environment clearly responds to effects in a quantifiable and/or qualifiable manner. Sites contain features of national or regional conservation or cultural designation, long term or permanent modification of anthropogenic activity.
Low	Environment responds in a minimal way to effects such that only minor changes are detectable. Sites of local nature conservation or cultural value, or temporary modification of anthropogenic activity.
Negligible	Environment responds in a minimal way such that only minor changes are detectable. Sites of local interest with little or no change to anthropogenic activity.

Table 23.13: Definitions for sensitivity of receptor

Magnitude of impact	Definition
Severe	An extreme change to the baseline condition of the receptor, exceeding AQS standards.
Major	A fundamental change to the baseline condition of the receptor, exceeding AQS standards.
Moderate	A detectible change resulting in the non-fundamental temporary or permanent condition of a receptor, may temporarily exceed AQS standards.
Minor	A minor change to the baseline condition of the receptor (or a change that is temporary in nature).
Negligible	An imperceptible and/or no change to the baseline condition of the receptor.

Table 23.14: Definitions for magnitude of impact for dust

23.4.5 Data gaps and uncertainties

23.109 This assessment includes some professional judgement of conditions and worst case estimates regarding noise and dust levels associated with the proposed development.

23.110 The assessment of impacts relating to dust is discussed qualitatively in the context of existing activities. No field measurements have been taken.

23.5 Baseline Description

23.5.1 Noise

23.111 The results of the attended and unattended noise monitoring are summarised in Table 23.15. It should be noted that the large difference between the ambient noise levels during the daytime and night-time at locations 1 and 2 is because attended measurements were taken at the front of the property, near to the road, whereas unattended measurements were taken in the rear garden of the property, further from and partially screened from the road. Therefore, the attended measurements form a useful baseline for

assessing the effects of development traffic on residential premises along the A836, whereas the unattended measurements will be a more useful indicator of baseline noise affected by HDD / PCC noise.

Location		Ambient dB L_{Aeq}		Background dB L_{A90}	
		Average	Standard deviation	Average	Standard deviation
Attended survey results					
1	Daytime	64	±3	37	±2
2	Daytime	55	±2	38	±3
3	Daytime	62	±2	38	±3
4	Daytime	60	±4	37	±3
5	Daytime	46	±4	38	±3
6	Daytime	57	±8	36	±3
7	Daytime	56	±1	36	±3
Unattended survey results					
1	Daytime	45	±7	33	±6
	Night-time	33	±6	28	±4
2	Daytime	40	±5	30	±5
	Night-time	29	±6	24	±3

Table 23.15: Baseline noise survey results summary

23.112 Based on the results of the baseline noise measurements, Table 23.16 details the baseline noise levels that have been used in assessing the effects of noise due to operations of the site and HDD operations on the two closest residential receivers to the proposed HDD / PCC sites at Ness of Huna and Ness of Quoys.

Location	Daytime		Night-time	
	Ambient dB L_{Aeq}	Background dB L_{A90}	Ambient dB L_{Aeq}	Background dB L_{A90}
1 - Norwin	38	27	27	24
2 - Quoys	35	25	23	21

Table 23.16: Baseline noise levels used in assessment of operational noise

23.113 Table 23.17 details the baseline noise levels which have been used to assess the effects of HGV traffic and construction noise on the noise sensitive receiver locations. As development traffic and construction activities will only occur during daytime hours, only the daytime values are quoted.

Location	Daytime	
	Ambient dB L_{Aeq}	Background dB L_{A90}
1 - Norwin	61	35
2 - Quoys	53	35
3 - The Cottage	60	35
4 - East Mey	56	34
5 - Hill of Rigifa	42	35
6 - Roadside	49	33
7 - Highfield, Warse	55	33

Table 23.17: Baseline noise levels used in assessment of traffic noise

23.5.2 Dust

23.114 The construction area is located within the jurisdiction of The Highland Council who have a statutory duty to periodically review air quality in the area under the Environment Act 1995. The Highland Council published an Air Quality Progress Report (The Highland Council, 2010) which considers new monitoring data and identifies new development that needs to be included in the next update and screening assessment (USA) report which is to be submitted in 2012.

23.115 Monitoring reported in the progress report demonstrates that the air quality objectives are being met or are likely to be met where the target date is still in the future (relative to the publication of the report). The Project does not lie within or in close proximity to an Air Quality Management Area (The Highland Council, 2010).

23.116 Qualitatively, the site is located in a rural coastal area which is frequently exposed to strong winds. The majority of airborne dust in the area is therefore likely to be formed through mechanical generation, for example erosion of agricultural soils. The nearest sensitive receptors to the site are farm buildings and single dwellings spread throughout the study area, and the small village at Canisbay.

23.6 Impacts during Construction and Installation

23.6.1 Impact 23.1 - PCC/HDD site and cable route construction noise

Impact assessment

23.117 The predicted range of noise levels for each of the major phases of construction is given in Table 23.18. The reason for presenting a range of levels is that noise levels will vary depending on where equipment is operating at any one time. The lower end of the range represents the case where all of the equipment is operating at a point furthest from the receiver whereas the higher number represents a scenario where all equipment is operating at the closest point to the receiver. In reality, it is unlikely that these extremes will be encountered for significant periods of time. The noise model assumes that all equipment will be operating for 100% of the time, which is also unlikely. The higher numbers therefore represent an extreme worst case scenario which, even if it was to be encountered, would be for a very limited period of time. As an example, it is possible that the higher levels for construction of the access track and cable route would only be encountered whilst the equipment was operating at the closest point to each receiver. This scenario is rather similar to normal road works where higher levels of noise can be encountered for a short time before moving on down the road. These higher levels are therefore only likely to be encountered for a period of up to a few hours.

23.118 Whilst these activities may be clearly audible outside the properties, it is anticipated that undue disturbance will not be caused, given that it is for a relatively short period and would only occur during normal working hours. Even the highest noise levels are well below the guideline limit in Advisory Leaflet 72 and below the suggested MPS 2 limit of 70 dBA for temporary works lasting less than eight weeks.

Task	Predicted sound pressure level, dB $L_{Aeq,1h}$						
	Construction of access road	Construction of access road (including use of breaker)	PCC foundations	Erect PCC steel structure	Bury cables (plough method)	Bury cables (cut and back fill method)	Cable Landfall
Location 1 - Norwin	44 - 53	40 - 48	39 - 44	30 - 35	37 - 43	30 - 36	41 - 42
Location 1b - Huna House / The Bungalow	48 - 57	44 - 52	47 - 50	38 - 41	44 - 52	37 - 45	50 - 63
Location 2 - Quoys	40 – 47	43 - 51	41 - 44	33 - 35	38 - 43	31 - 36	43 - 44
Location 2b - Canisbay Kirk / Kirkstyle	41 – 54	45 - 58	41 - 44	32 - 34	39 - 43	32 - 36	42 - 43
Location 2c - Canisbay	40 – 56	44 - 60	40 - 43	31 - 35	38 - 42	31 - 35	41 - 43

Table 23.18: Predicted range of specific noise levels due to construction

23.119 Predicted typical ambient noise levels for construction are presented in Table 23.19. The predicted ambient levels include the baseline ambient noise level added to the predicted typical ambient noise during each phase of the works. Table 23.20 shows the predicted change in ambient noise during each phase of construction and Table 23.21 shows the resultant consequence rankings. It should be noted that, as described in paragraph 23.106, the criteria are strictly for impacts lasting more than eight weeks. It is considered highly unlikely that these higher levels will be experienced for this long and some relaxation should therefore be applied when interpreting the moderate impacts.

Task	Predicted typical ambient noise level with construction, dB L_{Aeq}						
	Construction of access road	Construction of access road (including use of breaker)	PCC foundations	Erect PCC steel structure	Bury cables (plough method)	Bury cables (cut and back fill method)	Cable Landfall
Location 1 - Norwin	51	47	43	39	43	39	43
Location 1b - Huna House / The Bungalow	55	50	49	42	50	44	60
Location 2 - Quoys	45	49	44	38	42	38	45
Location 2b - Canisbay Kirk / Kirkstyle	51	55	44	37	42	38	44
Location 2c - Canisbay	53	57	43	37	41	37	43

Table 23.19: Predicted typical worst case ambient noise levels due to construction

Task	Predicted change in ambient noise level due to construction, dB L_{Aeq}						
	Construction of access road	Construction of access road (including use of breaker)	PCC foundations	Erect PCC steel structure	Bury cables (plough method)	Bury cables (cut and back fill method)	Cable Landfall
Location 1 - Norwin	+13	+9	+5	+1	+5	+1	+5
Location 1b - Huna House / The Bungalow	+17	+12	+11	+4	+12	+6	+22
Location 2 - Quoys	+10	+14	+9	+3	+7	+3	+10
Location 2b - Canisbay Kirk / Kirkstyle	+16	+20	+9	+2	+7	+3	+9
Location 2c - Canisbay	+18	+22	+8	+2	+6	+2	+8

Table 23.20: Predicted change in ambient noise levels due to construction

Task	Consequence ranking for construction noise						
	Construction of access road	Construction of access road (including use of breaker)	PCC foundations	Erect PCC steel structure	Bury cables (plough method)	Bury cables (cut and back fill method)	Cable Landfall
Location 1 - Norwin	Minor	Minor	Minor	Negligible	Minor	Negligible	Minor
Location 1b - Huna House / The Bungalow	Minor	Minor	Minor	Negligible	Minor	Minor	Moderate
Location 2 - Quoys	Minor	Minor	Minor	Negligible	Minor	Negligible	Minor
Location 2b - Canisbay Kirk / Kirkstyle	Minor	Minor	Minor	Negligible	Minor	Negligible	Minor
Location 2c - Canisbay	Minor	Moderate	Minor	Negligible	Minor	Negligible	Minor

Table 23.21: Consequence rankings due to construction

23.120 In addition to the above analysis, Table 23.22 shows the number of buildings along the cable route which will be subject to noise levels above the indicated level at some point during the construction period. It should be noted that it is only anticipated that these noise levels will be reached for a very short period whilst the equipment passes the closest point to the building (perhaps only a few hours) and that noise levels at other times will be much lower. It should also be noted that the number of buildings includes a number of outhouses etc and therefore not all buildings will be inhabited.

Maximum sound pressure level to which building will be exposed to, dB $L_{Aeq,1h}$	Number of buildings exposed	
	Bury cables (plough method)	Bury cables (cut and back fill method)
> 70 dBA	11	4
> 60 dBA	32	20
> 50 dBA	70	46

Table 23.22: Number of buildings exposed to various noise levels during cable laying activities

23.121 It is acknowledged that a moderate impact may be encountered at Huna House, The Bungalow and at Canisbay for some activities due to the close proximity of the properties to the PCC/HDD sites and access tracks. However, as stated previously, this is for the worst case assumption of all equipment operating at the same time at the closest point to the receptor and will be for a very limited duration, perhaps only a few hours. Nevertheless, in recognition of the potential for a major impact at these locations, typical mitigation measures which represent best practice for construction sites are discussed in the following section.

23.122 The impact of construction noise on wildlife is examined separately in Section 18.

Mitigation

23.123 The principal contractor will be required to submit a detailed Construction Environmental Management Plan (CEMP) giving construction plant schedules, working hours, proposals to minimise noise emissions and predicted noise levels at houses, along with a programme of sample monitoring. This will be formulated in liaison with The Highland Council prior to commencement of construction. The principal contractor will be expected to:

- Reduce noise to a minimum using the best practicable means at all times and in agreement with The Highland Council;
- Fit exhaust silencers wherever possible;
- Maintain plant regularly, ensure it is accurately adjusted and that noise abatement measures (e.g. covers) are fully operational and used correctly; and
- Work to keep local residents and groups informed of the proposed working schedule, where appropriate, including the times and duration of any abnormally noisy activity that may cause concern.

23.124 In order to minimise the impact of construction noise, it is also proposed to confine noisy construction activity (excluding HDD activities) to the following times:

- Mondays to Fridays (excluding public holidays): 07:00 to 19:00;
- Saturdays: 07:00 to 13:00; and
- No noisy work on bank holidays and Sundays.

23.125 A noise monitoring procedure and schedule will be prepared and agreed with The Highland Council prior to commencement of work. It will cover critical phases of the site construction and plant commissioning. Typically the procedure would include noise measurements in the vicinity of the noise source(s) and the nearest housing.

MITIGATION IN RELATION TO IMPACT 23.1

- Submission of CEMP detailing predicted construction noise levels and mitigation measures to be used.
- Limit construction working times to minimise noise during sensitive periods.

Residual impact

23.126 Assuming that the above mitigation measures can be implemented in full, it is anticipated that the impact due to construction of the HDD site, PCC and cable routes can be kept to a minimum, especially when it is taken into account that the impacts will be transient in nature. The principal contractor will need to provide further information as part of the CEMP to quantify the level and duration of impact once more detailed construction information becomes available. It is anticipated that the character of sound due to normal construction works will be similar in nature to noise from tractors and other farm machinery currently prevalent in the area.

23.127 Assuming that a reduction of 5 - 10 dBA could be achieved through use of the mitigation methods described above, including the use of localised screening and hoardings where necessary, all of the predicted significance rankings would reduce to minor.

Sensitivity of receptor	Magnitude of impact	Consequence	Significance
High	Minor	Minor	Not Significant

23.6.2 Impact 23.2 - Construction and drilling traffic noise

Impact assessment

23.128 Based on the results of the traffic assessment in Section 22, the results of the construction and drilling traffic noise assessment are shown in Table 23.23.

Month	Total trips (present)	Total HGVs (present)	Total trips (2014)	Total HGVs (2014)	Construction HGVs	Total HGVs (2014 + construction)	% increase HGVs	Increase in HGV noise, dBA	Increase in total traffic noise, dBA
Aug	14,709	399	15,395	418	135	553	32	+1.2	+0.4
Oct	10,787	323	11,290	338	135	473	40	+1.5	+0.5
Feb	9,053	330	9,475	345	135	480	39	+1.4	+0.6
Apr	10,279	287	10,758	300	135	435	45	+1.6	+0.5
Jul	11,066	368	11,582	385	135	520	35	+1.3	+0.5

Table 23.23: Traffic noise impact assessment

23.129 Comparing to the impact criteria in DMRB, it is considered that the maximum increase in noise due to HGVs would result in a minor impact and is therefore not significant but requires ongoing management to ensure the impact remains within acceptable limits. It should also be bourne in mind that the increase in traffic noise will be temporary and levels will revert to normal once construction and drilling has ceased.

Sensitivity of receptor	Magnitude of impact	Consequence	Significance
High	Minor	Minor	Not Significant

MITIGATION IN RELATION TO IMPACT 23.2
▪ Although no significant impact has been identified, mitigation has been considered to ensure this remains the case. ▪ The local community should be kept informed of overall construction activities including details of types, levels and routes of traffic.

23.6.3 Impact 23.3 - Horizontal Directional Drilling noise

Impact assessment

23.130 The predicted noise contours for the HDD operations are shown in Figure 23.3 and Figure 23.4 and summarised in Table 23.24.

Location	Predicted specific noise level, dBA	
	Ness of Quoys site	Ness of Huna site
Location 1 - Norwin	27	41
Location 1b - Huna House / The Bungalow	24	49
Location 2 - Quoys	42	21
Location 2b - Canisbay Kirk / Kirkstyle	42	26
Location 2c - Canisbay	46	26
Location 3 - The Cottage	31	20
Location 4 - East Mey	19	15
Location 5 - Hill of Rigifa	17	13
Location 6 - Roadside	23	17
Location 7 - Highfield (Warse)	28	21

Table 23.24: Predicted noise levels from HDD operations

23.131 It should be noted that the precise location of the drilling equipment within the HDD site is not yet known and, consequently, the predicted noise levels could differ depending on the final configuration, although it is known that this will be a 24 hour operation. Furthermore, the drilling contractor has not yet been appointed so there is further uncertainty about the type of equipment that will be used. Nevertheless, it is considered that the modelling has considered a worst case scenario as there is considerable scope for mitigation of noise from the rig if required.

23.132 The impact of HDD operations has been assessed against the significance criteria for construction activities and this is presented in Table 23.25 for the daytime and Table 23.26 for the night-time.

Location	Ambient noise assessment, dBA				Consequence	Significance
	Baseline ambient	Specific noise	New ambient	Change		
Assessment for Ness of Huna site						
Location 1 - Norwin	38	41	43	+5	Minor	Not Significant
Location 1b - Huna House / The Bungalow	38	49	49	+11	Minor	Not Significant
Location 2 - Quoys	35	21	35	0	Negligible	Not Significant
Location 2b - Canisbay Kirk / Kirkstyle	35	26	36	+1	Negligible	Not Significant
Location 2c - Canisbay	35	26	36	+1	Negligible	Not Significant
Assessment for Ness of Quoys site						
Location 1 - Norwin	38	27	38	0	Negligible	Not Significant
Location 1b - Huna House / The Bungalow	38	24	38	0	Negligible	Not Significant
Location 2 - Quoys	35	42	43	+8	Minor	Not Significant
Location 2b - Canisbay Kirk / Kirkstyle	35	42	43	+8	Minor	Not Significant
Location 2c - Canisbay	35	46	46	+11	Minor	Not Significant

Table 23.25: Impact assessment for HDD noise – daytime

Location	Ambient noise assessment, dBA				Consequence	Significance
	Baseline ambient	Specific noise	New ambient	Change		
Assessment for Ness of Huna Site						
Location 1 - Norwin	27	41	41	+14	Minor	Not Significant
Location 1b - Huna House / The Bungalow	27	49	49	+22	Moderate	Significant
Location 2 - Quoys	23	21	25	+2	Negligible	Not Significant
Location 2b - Canisbay Kirk / Kirkstyle	23	26	28	+5	Minor	Not Significant
Location 2c - Canisbay	23	26	28	+5	Minor	Not Significant
Assessment for Ness of Quoys Site						
Location 1 - Norwin	27	27	30	+3	Negligible	Not Significant
Location 1b - Huna House / The Bungalow	27	24	29	+2	Negligible	Not Significant
Location 2 - Quoys	23	42	42	+19	Minor	Not Significant
Location 2b - Canisbay Kirk / Kirkstyle	23	42	42	+19	Minor	Not Significant
Location 2c - Canisbay	23	46	46	+23	Moderate	Significant

Table 23.26: Impact assessment for HDD noise – night-time

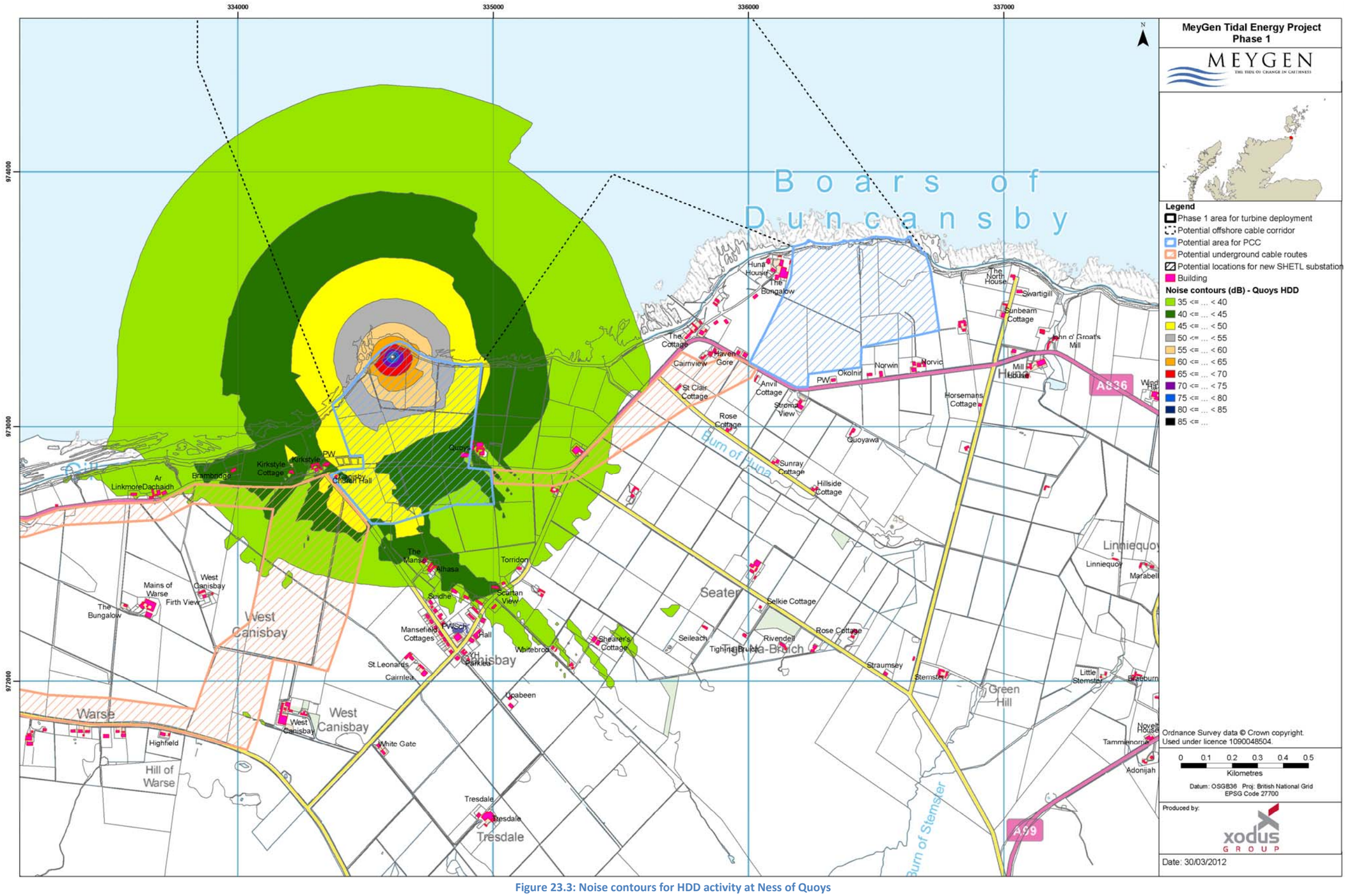

Figure 23.3: Noise contours for HDD activity at Ness of Quoys

Figure 23.4: Noise contours for HDD activity at Ness of Huna

Mitigation

23.133 Although the precise rig and specification has not been selected for the Project yet, it is possible to specify potential mitigation measures based on experience of undertaking noise control on other drilling rigs. It is recommended that mitigation measures contain a combination of some or all of the following, if required:

- Erection of noise barriers or baffle mounds between the rig and noise sensitive receiver locations;
- Erection of acoustic enclosure around the drilling rig;
- Installation of up-rated silencers to the rig generator exhaust;
- Installation of attenuators to air intakes and outlets;
- Installation of acoustic cladding to noise generating components; and
- Use of acoustic dampening materials.

23.134 Although it is difficult to estimate the likely benefit of such measures without a detailed understanding of the relative contribution of each noise source on the rig, it is considered likely that considerable reductions of between 10 - 20 dBA could be achieved.

23.135 It is proposed that a night-time noise limit of 45 dB $L_{Aeq,1h}$ and 60 dB L_{AFmax} at the nearest residential premises could be specified for HDD operations as part of any planning consent in order to ensure that noise from the operations does not result in sleep disturbance. The specification for mitigation measures will be dependent on the drilling rig equipment to be used and will be implemented if the rig is likely to exceed the proposed 45 dBA night-time noise limit.

MITIGATION IN RELATION TO IMPACT 23.3

- Submission of CEMP detailing predicted HDD noise levels and mitigation measures to be used.
- Installation of noise control engineering measures to rig and ancillary equipment.
- Use of enclosures, barriers and baffle mounds.
- Noise limit of 45 dB L_{Aeq} and 60 dB L_{AFmax} for night-time drilling operations at the nearest noise sensitive receptor.

Residual impact

23.136 Table 23.27 shows the residual impact assessment for HDD noise at night assuming that a reduction of 15 dBA can be achieved by installation of noise control measures to the drilling rig. The table shows the residual impact at the closest properties to each site during the night-time, which is the most critical time period.

23.137 Although there will be a change in night-time ambient noise levels at the closest properties to the HDD site during the drilling period, the impact will only be minor because the predicted noise levels are all below the WHO criterion for onset of sleep disturbance effects. As the overall significance of this impact will be minor it is therefore not significant but will require ongoing management to ensure the impact remains within acceptable limits.

Location	Ambient noise assessment, dBA				Consequence	Significance
	Baseline ambient	Specific noise	New ambient	Change		
Assessment for Ness of Huna Site						
Location 1b – Huna House / The Bungalow	27	34	34	+7	Minor	Not Significant
Assessment for Ness of Quoys Site						
Location 2c - Canisbay	23	31	32	+9	Minor	Not Significant

Table 23.27: Residual impact assessment for HDD noise – night-time

23.6.4 Impact 23.4 – Impacts due to airborne dust during construction

23.138 Construction dust emissions due to excavation and preparation of the PCC and HDD site, as well as transport of materials such as aggregate have the potential to transport dust throughout the construction area. Due to the high energy winds regularly experienced in the area airborne dust would easily be carried quickly over large distances. However, during such times when the wind transports large quantities of dust in the air, airborne dust is also likely to be dispersed rapidly.

23.139 Potential air quality impacts associated with the construction phase of the Project have been assessed qualitatively in terms of dust impacts on adjacent sensitive receptors. Examples of relative sensitivities of different receptors are listed in Table 23.28. No receptors have been identified as having Very High sensitivity or Negligible Sensitivity, based on the document *Minerals Policy Statement 2* (HMSO, 2005).

High sensitivity	Medium sensitivity	Low sensitivity
Hospitals and Clinics	Schools	Farms
Retirement Homes	Residential Areas	Light and Heavy Industry
Hi-Tech Industries	Food Retailers	Outdoor Storage
Food Processing	Offices	

Table 23.28: Dust sensitive receptors

23.140 The most sensitive receptor in the construction area has been identified as Canisbay which has dwellings, a school and a food retailer. This location is therefore taken as the worst case scenario as there is potential for construction activities to take place nearby (e.g. cable route) or for the wind to transport dust in the air to the village.

23.141 Construction dust has the potential to effect nearby receptors through soiling of surfaces or in fine particle form (which some of the dust may be) may have an adverse impact on human health. Construction dust emissions may also have an impact on short term PM_{10} concentrations in close proximity to the dust generating activities however all concentrations of pollutants are below air quality objectives in The Highland Council jurisdiction so a permanent or long term change to the concentrations of PM_{10} is not expected.

23.142 Assuming good construction management practices are put in place for all phases of construction it is considered that the magnitude of any impact due to dust would be minor and any changes will be temporary in nature. The sensitivity, as described above, is considered to be medium. The frequency of dust emissions, at a worst case, may be considered to be either regular over less than three years or intermittent over more than three years; therefore fitting into likelihood category three, Intermittent. This results in an overall impact of Minor and therefore not significant providing management ensures effects remain within acceptable limits.

Sensitivity of receptor	Magnitude of impact	Consequence	Significance
Medium	Minor	Minor	Not Significant

Mitigation: Construction Environmental Management Plan

23.143 A Construction Environmental Management Plan (CEMP) will be submitted detailing measures to ensure dust emissions are kept to a minimum. Such a document may include some of the following:

- Summary and timetable of all dust generating activities;
- List of dust and emission control methods to be used such as;
- Erection of effective barriers around dusty activities or the site boundary;
- Locating machinery or dust generating activities away from boundaries or sensitive receptors;
- Use of hard standing on site and for access track to limit dust generation during vehicle/plant movement;
- Dampening down of site area during dust generating activities and during particularly dry and windy conditions;
- Wheel washing of vehicles prior to leaving the site;
- Vehicles carrying dusty materials may be covered prior to leaving the site;
- Limiting the size of stockpiles/storage mounds and the duration they are there. These should be sited taking into account predominant wind direction; and
- Re-use of excavated hardcore material to avoid unnecessary vehicle trips.

23.144 The most appropriate measures for the Project at different stages will be applied, as recommended in the best practice guidance (Greater London Authority and London Councils, 2006).

MITIGATION IN RELATION TO IMPACT 23.4
▪ Submission of CEMP detailing measures to ensure dust emissions are kept to a minimum as described above.

23.7 Impacts during Operations and Maintenance

23.145 As there are no dust emissions associated with the O&M phase of the Project it has been scoped out and is not considered further.

23.7.1 Impact 23.4 – PCC operational noise

Impact assessment

23.146 Noise contours for PCC operations are shown in Figure 23.5 and Figure 23.6 and the predicted community noise levels due to operation of the PCC site are presented in Table 23.29. It should be noted that a negative decibel number means that the sound pressure is less than the reference pressure of 20 µPa.

Location	Predicted specific noise level, dBA	
	Ness of Quoys site	Ness of Huna site
Location 1 - Norwin	8	26
Location 1b - Huna House / The Bungalow	7	32
Location 2 - Quoys	26	8
Location 2b - Canisbay Kirk / Kirkstyle	26	9
Location 2c - Canisbay	28	11
Location 3 - The Cottage	13	4
Location 4 - East Mey	1	-3
Location 5 - Hill of Rigifa	-1	-5
Location 6 - Roadside	7	2
Location 7 - Highfield (Warse)	14	4

Table 23.29: Predicted noise levels due to PCC

23.147 The potential impact due to the operational phase of the Project will be principally due to the 24 hour operation of the PCC. The noise is likely to be steady in nature. The impact assessment for PCC operational noise during the daytime is detailed in Table 23.30. The table shows that the impact will be negligible at all of the locations and therefore not significant.

Location	Ambient noise assessment, dBA				Consequence (daytime)	Significance
	Baseline ambient	Specific noise	New ambient	Change		
Assessment for Ness of Huna site						
Location 1 - Norwin	38	22	38	0	Negligible	Not Significant
Location 1b - Huna House / The Bungalow	38	26	38	0	Negligible	Not Significant
Location 2 - Quoys	35	6	35	0	Negligible	Not Significant
Location 2b - Canisbay Kirk / Kirkstyle	35	5	35	0	Negligible	Not Significant
Location 2c - Canisbay	35	6	35	0	Negligible	Not Significant
Assessment for Ness of Quoys site						
Location 1 - Norwin	38	8	38	0	Negligible	Not Significant
Location 1b - Huna House / The Bungalow	38	7	38	0	Negligible	Not Significant
Location 2 - Quoys	35	26	36	+1	Negligible	Not Significant
Location 2b - Canisbay Kirk / Kirkstyle	35	26	35	0	Negligible	Not Significant
Location 2c - Canisbay	35	28	36	+1	Negligible	Not Significant

Table 23.30 Impact assessment for PCC noise – day-time

Figure 23.5: Noise contours for PCC operations at Ness of Quoys

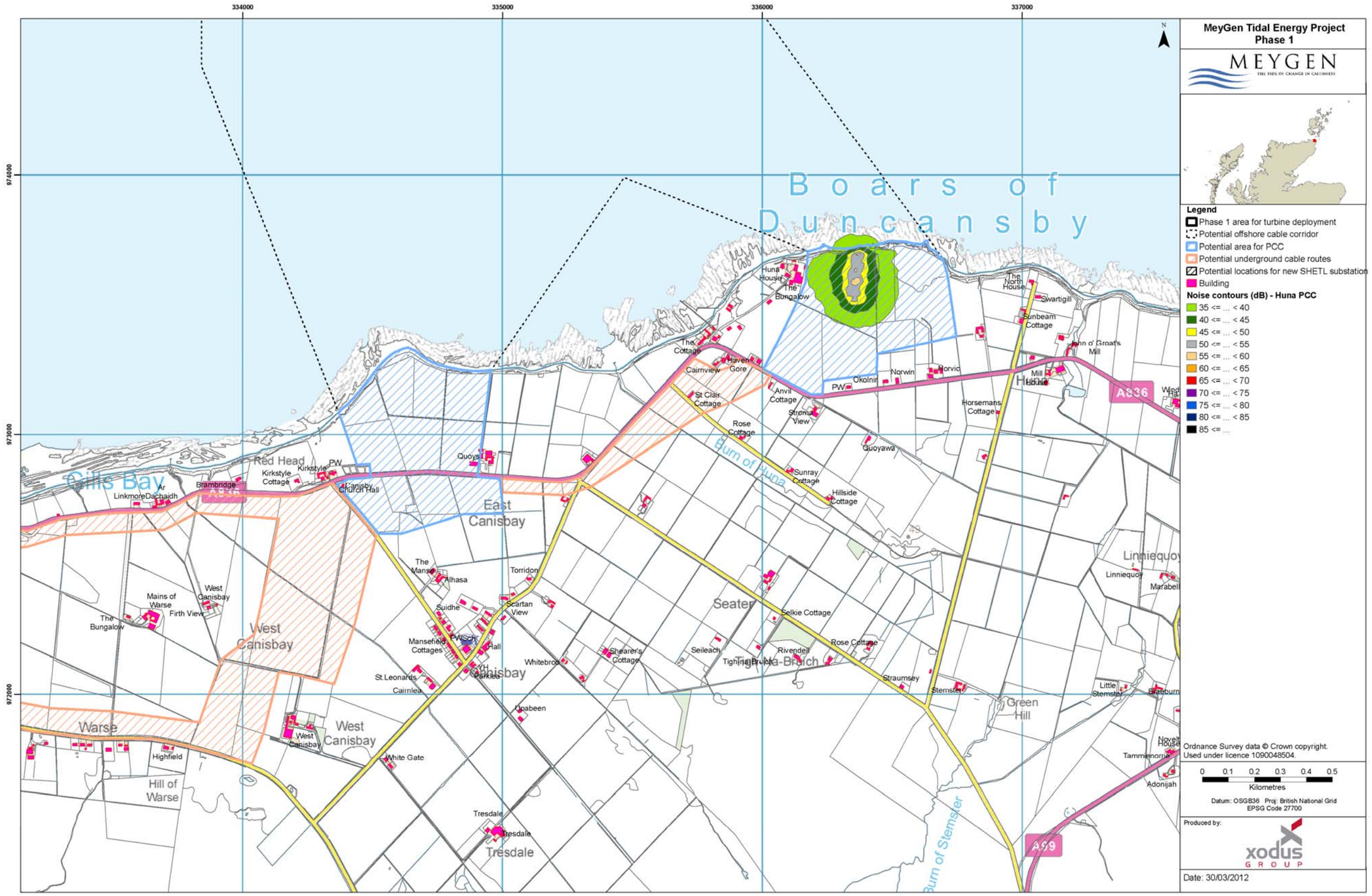

Figure 23.6: Noise contours for PCC operations at Ness of Huna

23.148 As well as examining the effect of the Project on ambient noise levels, it is also helpful to examine the likely short-term reaction of local residents to noise from the PCC site. A BS 4142 assessment can be useful in predicting the likely reactions of people to a new noise source before they have become accustomed to it. Table 23.31 shows a BS 4142 assessment for the daytime. However, it should be taken into account that the background noise level used in the assessment is very low (less than 30 dB LA90, as defined by BS 4142) and the specific noise level due to the Project is also very low (below about 35 dBA, as defined by BS 4142). The standard cannot therefore be applied robustly in this situation.

Location	BS4142 assessment, daytime			
	Background dB L_{A90}	Specific noise, dBA	Difference, dBA	Assessment
Assessment for Ness of Huna site				
Location 1 - Norwin	27	26	-1	Background noise level and rating level classified as very low and BS4142 not applicable.
Location 1b - Huna House / The Bungalow	27	32	5	Background noise level and rating level classified as very low and BS4142 not applicable.
Location 2 - Quoys	25	8	-17	Background noise level and rating level classified as very low and BS4142 not applicable.
Location 2b - Canisbay Kirk / Kirkstyle	25	9	-16	Background noise level and rating level classified as very low and BS4142 not applicable.
Location 2c - Canisbay	25	11	-14	Background noise level and rating level classified as very low and BS4142 not applicable.
Assessment for Ness of Quoys site				
Location 1 - Norwin	27	8	-19	Background noise level and rating level classified as very low and BS4142 not applicable.
Location 1b - Huna House / The Bungalow	27	7	-20	Background noise level and rating level classified as very low and BS4142 not applicable.
Location 2 - Quoys	25	26	+1	Background noise level and rating level classified as very low and BS4142 not applicable.
Location 2b - Canisbay Kirk / Kirkstyle	25	26	+1	Background noise level and rating level classified as very low and BS4142 not applicable.
Location 2c - Canisbay	25	28	+3	Background noise level and rating level classified as very low and BS4142 not applicable.

Table 23.31: BS 4142 assessment – PCC, day-time

23.149 The impact assessment for PCC operational noise during the night-time is detailed in Table 23.32. With the exception of the properties in the immediate vicinity of the PCC site, the impact will be negligible for all residential premises. For the few properties immediately adjacent to the PCC site, it is possible that a moderate impact could occur.

Location	Ambient noise assessment, dBA				Consequence (night-time)	Significance
	Baseline ambient	Specific noise	New ambient	Change		
Assessment for Ness of Huna site						
Location 1 - Norwin	27	26	30	+3	Minor	Not Significant
Location 1b - Huna House / The Bungalow	27	32	33	+6	Moderate	Significant
Location 2 - Quoys	23	8	23	0	Negligible	Not Significant
Location 2b - Canisbay Kirk / Kirkstyle	23	9	23	0	Negligible	Not Significant
Location 2c - Canisbay	23	11	23	0	Negligible	Not Significant
Assessment for Ness of Quoys site						
Location 1 - Norwin	27	8	27	0	Negligible	Not Significant
Location 1b - Huna House / The Bungalow	27	7	27	0	Negligible	Not Significant
Location 2 - Quoys	23	26	28	+5	Moderate	Significant
Location 2b - Canisbay Kirk / Kirkstyle	23	26	28	+5	Moderate	Significant
Location 2c - Canisbay	23	28	29	+6	Moderate	Significant

Table 23.32: Impact assessment for PCC noise – night-time

23.150 The BS 4142 assessment for the night-time is presented in Table 23.33. It is important to note that the background noise levels and specific noise levels from the site are both classified as very low according to BS4142 and the standard cannot therefore be robustly applied. The predicted specific and ambient noise levels as a result of the Project are all below the WHO / BS 8233 criteria for onset of sleep disturbance and well below the levels for onset of annoyance during the daytime. It is considered extremely unlikely that the noise produced by the PCC plant would result in a loss of amenity to residents at these levels.

Location	BS4142 assessment, night-time			
	Background dB L_{A90}	Specific noise, dBA	Difference, dBA	Assessment
Assessment for Ness of Huna site				
Location 1 - Norwin	24	26	+2	Background noise level and rating level classified as very low and BS4142 not applicable.
Location 1b - Huna House / The Bungalow	24	32	+8	Background noise level and rating level classified as very low and BS4142 not applicable.
Location 2 - Quoys	21	8	-13	Background noise level and rating level classified as very low and BS4142 not applicable.
Location 2b - Canisbay Kirk / Kirkstyle	21	9	-12	Background noise level and rating level classified as very low and BS4142 not applicable.

Location	BS4142 assessment, night-time			
	Background dB L_{A90}	Specific noise, dBA	Difference, dBA	Assessment
Location 2c - Canisbay	21	11	-10	Background noise level and rating level classified as very low and BS4142 not applicable.
Assessment for Ness of Quoys site				
Location 1 - Norwin	24	8	-16	Background noise level and rating level classified as very low and BS4142 not applicable.
Location 1b - Huna House / The Bungalow	24	7	-17	Background noise level and rating level classified as very low and BS4142 not applicable.
Location 2 - Quoys	21	26	+5	Background noise level and rating level classified as very low and BS4142 not applicable.
Location 2b - Canisbay Kirk / Kirkstyle	21	26	+5	Background noise level and rating level classified as very low and BS4142 not applicable.
Location 2c - Canisbay	21	28	+7	Background noise level and rating level classified as very low and BS4142 not applicable.

Table 23.33: BS 4142 assessment – PCC, night-time

Mitigation

23.151 Extensive mitigation measures have already been incorporated into the design of the PCC site, and are summarised as follows:

MITIGATION IN RELATION TO IMPACT 23.4

- Use of acoustic materials to clad the PCC buildings.
- Acoustically absorbent lining on inner façade of building.
- Installation of acoustic louvers for building ventilation.
- Orientation of PCC buildings so that any vent extracts point away from noise sensitive properties.

23.152 The precise mitigation measures incorporated in the final design will depend on several factors, including safety issues, ventilation requirements and structural considerations. It is proposed that a night-time noise limit of 35 dB $L_{Aeq,1h}$ at the nearest residential premises could be specified as part of any planning consent in order to ensure that noise from the operations does not result in sleep disturbance or significant loss of amenity.

Residual impact

23.153 It is worth noting that the baseline noise levels used in the assessment were taken during unusually calm meteorological conditions for the area, as requested by The Highland Council. Consequently, the impact assessment can be considered a worst case scenario. It is likely that background noise due to the wind would be much higher for the majority of the time, meaning that the impacts reported in this section would be less than predicted.

23.154 A BS 4142 assessment is not appropriate in assessing the residual noise levels because both the background noise levels and the rating levels for all of the locations are below the values considered by BS 4142 to be very low. In this regard, it is important to note that the absolute noise levels resulting from permanent operations will be well below the WHO criterion for onset of sleep disturbance effects at night or annoyance during the daytime.

23.155 With respect to the impact on quality of life (amenity, enjoyment of property etc.), it has been established that the development will result in, at most, a 6 dBA increase in ambient noise during the quietest period of the night during the quietest nights of the year for the properties closest to the PCC site. It is unlikely that noise from the PCC site would be perceptible in properties with the windows closed at night (above household sounds such as fridges and boilers). Internal noise levels are likely to be in the order of 18 dBA or less at night with windows partially open. Thus, even if windows were left open at night to allow for ventilation when sleeping, the noise is unlikely to have an adverse effect, even if it is audible.

23.156 Baseline ambient noise levels in the day are relatively high compared to the calculated specific noise from the plant. Consequently, the proposed development is unlikely to influence ambient noise levels during the daytime when amenity is the primary concern. In terms of the absolute noise level assessment, noise from plant will be significantly less than the 50 dB L_{Aeq} guideline limit in BS 8233 for amenity areas (e.g. gardens) during the daytime. Thus, taking both the change in noise level and absolute assessment into consideration, it is considered that the proposed development will not result in a significant adverse impact to quality of life.

23.157 It is also worth noting that the predicted change in ambient noise used in the assessment would not occur overnight. In reality, the development is being staged over a number of years. People would be able to become gradually more accustomed to the change in the noise environment in smaller steps rather than being exposed to a larger change overnight.

23.158 Consequently, and taking all of these factors into account, it is concluded that operational noise will not result in a significant loss of amenity or health impact at residential properties, even during the calmest nights.

23.8 Impacts during Decommissioning

23.159 Decommissioning activities are unlikely to substantially differ from the activities as described under the potential impacts for construction in Section 23.6. The conclusions regarding significance will therefore remain the same or lower.

23.9 Potential Variances in Environmental Impacts

23.160 There is scope for the environmental impacts predicted for onshore noise to vary depending on the final site, configuration, design and specification chosen for the construction and operation of the PCC and cable routes and the HDD site. It is difficult to quantify the potential variance at this stage of the Project, but any increase in impact at one property would likely to be offset against a reduction in impact at another property. Thus, it is likely that the overall impacts and conclusions would remain unchanged, and only the location of the residential property affected by that impact would change. It is proposed that the potential for significant variance in impact (for the worse) could be avoided by relevant use of planning noise limits to keep noise levels to within acceptable values.

23.161 It is considered unlikely that any other options selected for construction would change the conclusions drawn on the potential impacts of airborne dust as the most sensitive receptor in the vicinity of the development has been selected for assessment.

23.10 Cumulative Impact

23.10.1 Introduction

23.162 MeyGen has in consultation with Marine Scotland and The Highland Council identified a list of other projects (MeyGen, 2011) which together with the Project may result in potential cumulative impacts. The list of these projects including details of their status at the time of the EIA and a map showing their location is provided in Section 8; Table 8.3 and Figure 8.1 respectively.

23.163 Having considered the information presently available in the public domain on the projects for which there is a potential for cumulative impacts, Table 23.34 below indicates those with the potential to result in cumulative impacts from a noise and dust perspective. The consideration of which projects could result in potential cumulative impacts is based on the results of the project specific impact assessment together with the expert judgement of the specialist consultant.

Project title	Potential for cumulative impact	Project title	Potential for cumulative impact	Project title	Potential for cumulative impact
MeyGen Limited, MeyGen Tidal Energy Project, Phase 2	✓	SHETL, HVDC cable (onshore to an existing substation near Keith in Moray)	×	OPL, Ocean Power Technologies (OPT) wave power ocean trial	×
ScottishPower Renewables UK Limited, Ness of Duncansby Tidal Energy Project	×	Brough Head Wave Farm Limited, Brough Head Wave Energy Project	×	MORL, Moray Offshore Renewables Ltd (MORL) offshore windfarm	×
Pelamis Wave Power, Farr Point Wave Energy Project	×	SSE Renewables Developments (UK) Limited, Costa Head Wave Energy Project	×	SSE and Talisman, Beatrice offshore Windfarm Demonstrator Project	×
Sea Generation (Brough Ness) Limited, Brough Ness Tidal Energy Project	×	EON Climate & Renewables UK Developments Limited, West Orkney North Wave Energy Project	×	BOWL, Beatrice Offshore Windfarm Ltd (BOWL) offshore windfarm	×
Cantick Head Tidal Development Limited, Cantick Head Tidal Energy Project	×	EON Climate & Renewables UK Developments Limited, West Orkney South Wave Energy Project	×	Northern Isles Salmon, Chalmers Hope salmon cage site	×
SSE, Caithness HVDC Connection - Converter station	✓	ScottishPower Renewables UK Limited, Marwick Head Wave Energy Project	×	Northern Isles Salmon, Pegal Bay salmon cage site	×
SSE, Caithness HVDC Connection - Cable	✓	SSE Renewables Developments (UK) Limited, Westray South Tidal Energy Project	×	Northern Isles Salmon, Lyrawa salmon cage site	×
RWE npower renewables, Stroupster Windfarm	×	EMEC, Wave Energy test site (Billia Croo, Orkney)	×	Scottish Sea Farms, Bring Head salmon cage site	×
SSE, Gills Bay 132 kV / 33 k V Substation Phase 1: substation and overhead cables (AC)	✓	EMEC, Tidal energy test site (Fall of Warness, Orkney)	×	Northern Isles Salmon, Cava South salmon cage site	×
SSE, Gills Bay 132 kV / 33 k V	✓	EMEC, Intermediate wave	×	Scottish Sea Farms, Toyness	×
Substation Phase 2: HVDC converter station and new DC buried cable		energy test site (St Mary's Bay, Orkney)		salmon cage site	
SHETL, HVDC cable (offshore Moray Firth)	×	EMEC, Intermediate tidal energy test site (Head of Holland, Orkney)	×	Northern Isles Salmon, West Fara salmon cage site	×

Table 23.34: Summary of potential cumulative impacts

23.164 The following sections summarise the nature of the potential cumulative impacts for each potential project phase:

- Construction and installation;
- Operations and maintenance; and
- Decommissioning.

23.10.2 Potential cumulative impacts during construction and installation

23.165 For noise, there is a possibility that there could be a cumulative impact for construction of the cable routes and other infrastructure for some of the other energy projects in the area where such projects will come within close proximity to the MeyGen cable routes. However, without details of the construction schedule or defined routes/locations it is difficult to quantify the potential effect at this time.

23.166 It is possible that the Gills Bay 132 kV / 33 kV Substation and cable route could result in a cumulative impact. Construction is likely to start in April 2013 so there is likely to be overlap for the construction period.

23.167 Further projects identified in the region, but without construction timescales, may have an effect on air quality, however without details of their construction it is not possible to reasonably assess the potential cumulative effect.

23.10.3 Potential cumulative impacts during operations and maintenance

23.168 With respect to operational noise, it is highly unlikely that there would be a cumulative effect with any other development unless it was located immediately adjacent to the MeyGen PCC.

23.169 During the operational phase the Project has very little terrestrial activity. Given that the other identified terrestrial projects in the region are energy related and unlikely to be high dust-generating projects, the cumulative effect of both noise and dust the Project in combination with other terrestrial projects in the region is considered negligible and therefore not significant.

23.170 In terms of MeyGen Phase 2, the exact geographical location and nature of the onshore facilities required are not yet defined and will incorporate lessons learned from and technology advancements beyond Phase 1 of the Project. These factors will influence the potential for, nature of and significance of any cumulative impact. From a noise and dust perspective, the requirement for additional onshore infrastructure has the potential for cumulative impacts.

23.10.4 Potential cumulative impacts during decommissioning

23.171 There are no predicted cumulative impacts for noise during decommissioning.

23.10.5 Mitigation requirements for potential cumulative impacts

23.172 No mitigation is required over and above the Project specific mitigation.

23.11 Proposed Monitoring

23.173 It is proposed to undertake surveys during construction and operational phases of the Project to monitor noise emissions against consented levels.

23.12 Summary and Conclusions

23.174 This section has considered the noise and dust impacts from onshore elements of the Project, including the two possible PCC and HDD site locations at Ness of Quoys and Ness of Huna, construction of the PCC and HDD sites, cable installation works and construction and drilling traffic.

23.175 A noise model of construction, HDD and PCC noise has been developed based on available information from equipment manufacturers and from other, similar, developments.

23.176 The noise assessment has considered both long-term and short-term effects of noise and has assessed both the change in ambient noise as well as the absolute level of noise.

23.177 For construction and installation noise, good practice noise mitigation measures have been recommended, in addition to potential construction noise limits, in order to ensure that noise levels are kept below a level that would be considered to be a significant impact.

23.178 For HDD noise, which will operate through the day and night, it is likely to be necessary to install mitigation measures to the drilling rig and consider use of enclosures or baffle mounds. The predicted residual noise levels are all below the WHO criterion for onset of sleep disturbance effect and, although there will be an increase in night-time ambient noise levels at the closest properties to the HDD site during the drilling period, the impact will only be minor and therefore not significant.

23.179 In terms of dust, the only dust generating activities are associated with construction activities (excavation, HDD and transport of materials e.g. aggregate). Airborne dust has been assessed qualitatively using a worst case estimate of magnitude and sensitivity and found not to have a significant impact providing good construction practices are put in place. Air quality issues associated with vehicles during any phase of the Project are discussed and scoped out in Section 22.

23.180 During operation of the site, noise levels will be much lower than for the construction and HDD activities. Residual noise levels will all be well below the WHO criterion for onset of sleep disturbance or annoyance and would be classified by BS 4142 as being “very low”. Although the change in noise levels might be discernable outside during the quietest period of the calmest nights, it is unlikely to be audible during the daytime or inside the properties during the night. The design will incorporate significant mitigation measures to minimise noise levels to the lowest practicable level. It is therefore concluded that it is unlikely that the Project will result in a significant loss of amenity to residents.

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